Under Surveillance: Does Global Positioning System (GPS) Monitoring of Offenders Really Work and What Does the Dynamic Risk Assessment Offender Re-Entry (DRAOR) Really Tell Us?

By Anna Hawkes

A thesis submitted to Otago University of Dunedin in fulfilment of the requirements for the degree of Master of Arts in Psychology

2020

University of Otago

Te Whare Wānanga o Otāgo

Acknowledgements

First and foremost, I would like to thank my supervisors Professor Martin Sellbom and Dr Fairleigh Gilmour, for your guidance, encouragement, knowledge and patience (particularly with my statistical ability – thank you Martin!!!) throughout this journey. You have both been amazing and I am grateful for the opportunity to have worked with and learned from you both.

Thank you to the Department of Corrections for their support and for providing the data for this research project. Thank you Su-Wuen for dealing with my numerous requests. I would also like to acknowledge the Department of Corrections Southern Regional Leadership Team in their support, but in particular, Glenn for always having my back, Kelly for being there for anything and everything and Polly for listening and understanding what I needed when I hit a few bumps in the road.

The completion of this thesis would not have been possible without the love and support of some truly wonderful people. To my family, friends and team I cannot thank you enough for all your help with juggling work, study, home and the boys. Michelle, Mike and Helen I am ever so grateful to have you as my proof-reading gurus. Kim thank you for dealing with my formatting issues, I would be lost without you.

To the most magical creatures in my world, Cooper and Arlo you provide my inspiration, innovation, determination and love for life. I hope you are proud of what your mum has achieved and that this inspires you to see and know anything is possible.

Lastly, this is for you mum!

Note: Statements and opinions expressed in this thesis are those of the author and do not represent the views of the New Zealand Department of Corrections.

Abstract

Appropriate supervision and risk assessments are critical in offender management, but require effective tools and accurate risk assessments to guide decisions and interventions appropriately. This research sought to investigate the effectiveness of Global Positioning System (GPS) monitoring in preventing re-offending, whilst considering the impact of GPS monitoring on the offender's psychological and emotional wellbeing. The second aim was to evaluate the utility of the Dynamic Risk Assessment Offender Re-entry (DRAOR) in predicting future re-offending and examining whether such predictions were different in a matched sample of GPS monitored offenders (n = 220) versus non-GPS monitored (n =219) over a 24-month follow-up period. All participants were male offenders released from prison within New Zealand. The results showed statistically significant differences for 'non-violent' and 'violent' re-offending rates, with GPS monitoring being associated with lower rates of recidivism. The findings demonstrated that the DRAOR may be better at predicting violent and general recidivism, rather than technical violations and overall re-offending in this sample. There was no evidence of increased psychological distress in those men subject to GPS monitoring. The DRAOR's utility in predicting re-offending came primarily from the Stable scale, demonstrating the highest predictive accuracy for re-offending when compared to the Acute and Protective scales. The final assessment predicted re-offending better than the initial assessment. The amount of change on the DRAOR scores was dependent on the individual's re-offence status, in that the scores had decreased more substantially for those who did not re-offend compared to those who did, demonstrating the value in monitoring risk. However, the DRAOR's utility in predicting future re-offending was essentially identical across GPS and non-GPS monitored groups.

Table of Contents

List of Tables

List of Figures

Introduction

Many criminal justice jurisdictions have stand-alone sentences or conditions which require the monitoring of an individual's location or whereabouts. Electronic monitoring (EM) is a technological means of enforcing such sentences or conditions. The technology allows for tracking of an individual's movements and as such can be used in detention, restriction and surveillance (Black & Smith, 2003).

Evaluating the impact of EM is difficult given the number of different operating procedures, programmes, offender profiles, technologies and methodological approaches. EM has been used for a variety of purposes, such as a stand-alone sentence, monitoring of bail conditions or as an alternative to a prison sentence, thereby reducing the prison population. It has been used to rehabilitate offenders when it has been a condition of sentences and orders, allowing them to remain in the community. This multitude of uses has resulted in a number of EM programmes, targeting differing offender cohorts and involving different levels of supervision and support (Gainey & Payne, 2000).

Research has highlighted a number of issues surrounding EM, particularly in Australasia, Britain, Europe and the United States. The reduction of recidivism rates associated with EM programmes has varied, with some re-offending rates being recorded at 30% (Mortimer, 2001) and others recorded re-offending rates at 70-80% (Sugg, Moore, & Howard, 2001). These rates have varied depending on the definition of recidivism, how it is measured, when it is measured and the type of monitoring programme. Recidivism rates were shown to be lower for those offenders who were older and were subject to EM as conditions of their release from prison (Gainey & Payne, 2000). Youth offenders and those with extensive criminal histories tended to have a higher failure rate (Smith, 2001) than those who were lower-risk offenders (Bishop, 1996; Whitfield, 1997). Bonta, Wallace-Capretta and Rooney (1999) found that EM did not reduce the re-offending rates of low-risk offenders and EM programmes targeting this group may be ineffective. By way of contrast Lilly, Ball,

Curry and McMullen (1993) considered the completion rates over a seven-year period for a number of offenders subject to home confinement with EM. The study demonstrated high completion rates at 97%, with offenders successfully complying with their home confinement. Further research has found that when EM has been used in-conjunction with interventions and programmes, this has been effective in reducing re-offending rates (Bonta et al, 1999; Lilly et al., 1993). There is still much work to be done to understand how EM impacts recidivism. The use of EM varies across the different correctional jurisdictions and is used differently within the offending population. Consequently, it is critical to research the effects of EM to determine how EM can be most effectively used with offenders.

Risk assessment is critical in offender management, and research has focused on identifying factors that influence an individual's likelihood of offending. However, there is significant debate regarding which assessment approaches have the greatest utility. Research in the risk assessment has utilised the adult male population as the prime sample group, with the belief that the generalisability of these findings will apply to other offending populations. Despite a number of offending relating factors being applicable to different groups, there are also a number of differences in the offending population which are not always considered. For example, mental health issues are a risk factor for youth offending, but not for an adult offender (Borum, 2003). In addition, some factors have been identified to be more influential at different stages of an offender's life. For example peer association as a youth offender is more influential than in adulthood (Hoge, Vincent & Guy, 2012).

A number of risk assessment tools have been developed to assess risk within a number of differing populations and a number of studies have been conducted to validate these instruments (Andrews & Bonta, 2010). However, advancements in this field are still required. One such research gap is how EM, specifically GPS monitoring, moderates a person's risk prediction, along with the impacts of monitoring on the offender.

The purpose of this study is to examine the impact and effectiveness of GPS monitoring in preventing or deterring further criminal activity by offenders, and to consider the impact of 24-hour monitoring on offenders' psychological and emotional wellbeing. This study further sets out to examine the predictive utility of the Dynamic Risk Assessment Offender Re-Entry (DRAOR; Serin, 2007) as applied in a probation setting for GPS versus non-GPS monitored offenders within New Zealand.

The following literature review begins with a brief summary of supervision of offenders in the community, exploring the evolution of supervision theories and models to the introduction of risk assessments and EM as a supervision tool within correctional jurisdictions. The review then looks at the history and implementation of EM, as it is important to understand the varying EM programmes in differing jurisdictions and how and with whom it is used with in the New Zealand context. I then present the existing empirical evidence evaluating EM and its effectiveness in reducing re-offending, including radio frequency and GPS monitoring, and highlight the gaps in existing literature this study will fill. I will then discuss the evidence from studies highlighting the detrimental impacts of EM on individuals, as a key research question of this study is to understand the effect of the surveillant nature of EM on offenders. The literature review then explores the practical and theoretical concepts of criminal conduct and how these theories underpin the development of risk assessments, leading to a review of the evolution and generations of risk assessment methods. Finally, this review discusses the nature of dynamic risk and protective factors, with an emphasis on their inclusion in risk assessment instruments. It is important to understand how risk assessments have been developed and enhanced to assist with more accurate assessment of individual risk, predictive utility in recidivism and supporting more effective offender management. The DRAOR which is the contemporary risk assessment used in New Zealand Community Probation and its properties along with several studies examining its

predictive utility are discussed in detail. Drawing the literature review together, I then present the rationale and research questions for the current study.

Supervision of offenders in the community

Community supervision has been an integral part of the corrections system since the establishment of the probation services, more than 100 years ago. Indeed, community-based sentences are a widely used sanction (Barton-Bellessa & Hanser, 2012). The supervision of offenders in the community provides an alternative sentencing option to imprisonment, particularly for individuals who commit less serious crimes. The court or parole board can also order offenders to serve a period of supervision in the community following sentences of imprisonment.

The alternative of community-based sentencing options allows for many offenders to avoid the detrimental effects of imprisonment while still holding them accountable for their actions (Andrews & Bonta 2010; Bonta & Wormith, 2013). These options allow offenders to maintain relationships with whānau, family and friends, to maintain employment and to remain connected to their community. Offenders who have remained in the community have been shown to re-offend less frequently, with a 35% reduction in re-offending rates when compared to a 17% reduction for those who have been imprisoned (Andrews & Bonta, 2006). There is evidence that imprisonment is likely to increase the risk of re-offending among offenders which subsequently compromises public safety (Teague, 2011). Furthermore, supervision of offenders in the community is much more cost effective than imprisonment. In the 2018/2019 financial year, the average cost per day for a sentenced prisoner in New Zealand was $338 ($123,370 per annum), whereas the cost of EM on average for an offender per day was $69 ($25,185 per annum) (Department of Corrections, 2019).

Over 30,000 offenders in New Zealand are serving their sentences in the community compared to 10,000 in prisons (Department of Corrections, 2019). While community supervision does provide for a safe and inexpensive way to hold offenders accountable for

their crimes, there has been a long-standing tension between balancing the objectives of ensuring public safety and the rehabilitation and reintegration of offenders (Skeem & Manchak, 2008). Most interventions and treatments to aid in rehabilitation such as trade training and anger management programmes have been delivered in prisons. Researchers have also argued that rehabilitation should also be considered within community-based sentences (Paparozzi & Gendreau, 2005). In the latter half of the 20th century, justice agencies favoured offender rehabilitation while punishment was considered of little utility (Menninger, 1968). In the 1960s, the supervision of offenders was strongly linked to psychotherapeutic models, focused on personal interaction to help individuals change their behaviour and address problems in an appropriate way (Paparozzi & Gendreau, 2005). This approach was widely accepted to exhibit reductions in re-offending rates of 20% to 50%, while leading to higher rates of employment and the acquisition of educational skills (Ross & Gendreau, 1980; Cromwell & Killinger, 1994).

The 1970s saw a significant shift in probation policy (Robinson, 2013). The growth in the prison population and emergence of increasing re-offending rates for offenders on community-based sentences, led some criminologists and psychologists to question the effectiveness of community-based sanctions. This questioning resulted in the introduction of a brokerage model of service delivery moving away from individual casework completed by probation officers. It was contended that community-based rehabilitation failed to address offending rates and that reintegrative needs such as employment, education and accommodation would more appropriately be addressed by external agencies (Cromwell & Killinger, 1994). Not all agreed with this shift in correctional philosophy, with rehabilitation and punishment being two distinct and conflicting goals. Many argued that supervision without intervention components are ineffective in reducing re-offending (Bonta & Andrews, 2010; Taxman 2008). Nonetheless, community supervision moved away from a clinical model of assessment and treatment to a managerial model, with probation officers focused on

determining offender needs and referring the offender to the appropriate agency in the community to address those needs (Feeley & Simon, 1992). Throughout the late 1990s and early 2000s there was a shift away from intervention and treatment towards the philosophy of a ‘just deserts’ model of justice. This model represented the approach of fair and appropriate punishment which matched the severity of the offence. This philosophy was also known as the 'retribution' approach to sentencing (Steen & Bandy, 2007). The intent was to ensure offenders complied with their sentences and orders and held offenders accountable when they did not. Fundamental to holding offenders to account, was the use of sanctions and prosecutions (von Hirsch, 1990). With retribution as the guiding principle and an emphasis on punishment, certain New Zealand politicians utilised this ideology for their political gain. This saw the development and passing of new legislation, reflecting a ‘tough on crime’ standpoint (Steen & Brandy, 2007). This approach emphasised holding the individual accountable for their crimes rather than a focus on addressing the rehabilitative and reintegrative needs of the individual (Cromwell & Killinger, 1994). With little research or data to illustrate the effectiveness of community supervision in reducing recidivism, the focus of supervision became punitive by holding the individual to account for their actions rather than assisting in transforming the individuals’ life (Simon, 1993). Despite the ongoing variability in perspectives between models of punishment versus rehabilitation and reintegration over the years, research focused on offender risk assessment has received substantial consideration for more than three decades. Risk assessment is vital to the management of offenders in the correctional system; it informs the individual’s pathway for intervention and treatment and aims to ensure that the person is matched to the most appropriate programmes (Andrews et al., 2006; Bonta, 2002; Hildebrand, Hol & Bosker, 2013). Risk assessments have been derived from empirical observation and clinical judgement, resulting in tools being developed to predict a number of outcomes, including the likelihood of an individual re-offending (Andrews & Bonta, 2010).

A risk assessment involves assessing a number of variables that are associated with future criminal conduct. Most assessments follow the theory that risk is determined by a number of or a combination of variables; no single variable is a strong or single predictor of risk (Mann, Hanson & Thornton, 2010). The combination of offending related factors is used to predict the probability of an individual offending at some point in the future. If the individual has previously been convicted of an offence the assessment tends to focus on the likelihood of the individual re-offending. Structured methods of assessing and combining risk related factors have been found to be more accurate in predicting re-offending rates, rather than assessments reliant on professional judgement (Andrews et al., 2006; Hanson & Morton-Bourgon, 2009).

Re-offending rates tend to be at their highest in the initial weeks and months following release from prison (Burnett, 2009; Nadesu, 2007). Faced with a multitude of practical, social, financial and personal barriers upon leaving prison, many individuals find themselves unprepared and ill-equipped for their release into the community (Solomon, Govis & Waul, 2001; Visher & Travis, 2012). The transition from imprisonment to the community requires the offender to make significant changes in preparation to lead an offence free life. Bonta, Rugge, Scott, Bourgon and Yessine (2008) found case management strategies utilised by correctional staff were not comprehensive enough, with the prisoner often being unprepared for release into the community. Serin, Lloyd and Hanby (2010) found supervision following imprisonment to be a critical factor and an effective tool supporting reintegration and re-entry into the community, but for supervision to be successful, accurate risk assessments are required. Risk assessments have become a standardised practice within correctional jurisdictions, with correctional staff administrating these assessments on a consistent basis to determine an individual's risk, criminogenic needs and responsivity issues, guiding important decisions about ongoing supervision (Serin, 2007; Bosker, Witteman, & Hermanns, 2013). Furthermore, for supervision of an offender to be successful not only are accurate risk

assessments required but also effective tools and interventions. One such tool in the correctional field is EM. The increasing trend to use EM around the world is primarily due to its surveillance abilities, however, EM can also facilitate an offender's rehabilitation.

Electronic monitoring (EM)

Technological advancements have enabled the use of new forms of surveillance and control of offenders. The EM of offenders came as a result of New Mexico State Judge Jack Love being inspired by a Spiderman cartoon in 1977 (Fox, 1987). In the cartoon, a criminal attached an electronic bracelet to Spiderman to keep track of his whereabouts. The Judge thought that crime could be controlled if similar devices were available for offenders (Mair, 2005). In the mid-1980s EM was implemented in the United States (Fox, 1987; Whitfield, 1997), and it was during the late 1980s that it was introduced to the United Kingdom (Nellis, 2000). It is now used in several countries including Australia, Canada, Finland, Israel, New Zealand, Scotland, Singapore, Sweden, and the Netherlands.

EM requires the offender to wear an electronic anklet. The anklet must be worn 24-hours a day, seven days a week for the duration of the sentence. A monitoring unit is installed at the offender's residence. The anklet transmits signals to a monitoring centre through the cellular network; this permits the monitoring of the offender's movements in and outside of the home (Whitfield, 1997). The real-time monitoring allows correctional services to determine whether the person is complying with the conditions of their sentence or order. These conditions generally relate to temporal and geographical restrictions, such as locations the offender is not to go or where they should be, curfews and programmes (Kornhauser & Laster, 2014; Nellis, 2013).

There are two main forms of EM technology: radio frequency, which was first introduced in the 1980s but became more readily available in the 1990s; and GPS, which was first implemented in the late 1990s (Martinovic, 2013). Radio frequency technology is specifically used to monitor the offender at their detention residence or place of employment

and is utilised more extensively with low to medium risk offenders. This technology is more widely used across correctional jurisdictions. Currently, more than 30 countries have used this tool in offender management (Bartels & Martinovic, 2017). However, radio frequency cannot provide information on the offender's whereabouts outside of their monitored location. GPS monitoring technology is not as extensively utilised as radio frequency. It has only been since 2012 that countries such as Australia, Brazil, New Zealand, Spain, Sweden, and the United States have introduced this technology in offender management (Nellis, 2013). More recently, other jurisdictions such as Belgium, Canada, Germany, the Netherlands and the United Kingdom have employed this technology. It is typically used with high-risk offenders such as sex offenders and violent offenders. This second-generation technology provided correctional jurisdictions with the ability to track offenders' movements and whereabouts 24-hours a day, seven days per week.

EM in New Zealand was first introduced in the form of home detention in the 1990s. This was in response to the perceived need to create an effective alternative to imprisonment. A small home detention pilot was established from 1995 until 1997 for offenders released on parole and subject to a special condition of monitoring. Telephone calls and voice verification were utilised in addition to the electronic equipment to ensure the offenders complied with their conditions (Church & Dunstan, 1997). An evaluation of the pilot study was conducted after 18 months. A total of 37 prisoners were released on home detention; of those released, 11 re-offended (Church & Dunstan, 1997). Prisoners preferred the less restrictive option of parole over an early release subject to home detention; therefore, it was determined this approach was unlikely to reduce the prison population. There was no evidence to show home detention was a viable reintegration tool (Gibbs & King, 2003). Nonetheless, home detention was implemented nationwide in 1999.

Home detention was introduced as a 'front-end' sentence and a 'back-end' order for those applying for early release from prison. Offenders who received a short-term of

imprisonment (e.g., two years or less) were granted leave to apply to serve their sentence by way of home detention for up to a period of 12-months. Offenders who received a sentence of imprisonment of over two years were able to apply for 'back-end' home detention five months prior to their parole eligibility date. This application went before the New Zealand Parole Board (NZPB) and if the prisoner was successful, the individual would be released and subject to home detention for three months prior to their parole eligibility (Gibbs & King, 2003).

The EM scheme was administered by the Department of Corrections. Probation officers conducted suitability assessments for the offenders, considering the nature of their offence, their previous criminal conviction history, risk, rehabilitation and reintegration needs and accommodation including the welfare and safety of the occupants within the home. The purpose of home detention was monitoring, rehabilitation and reintegration.

The Sentencing Act 2002 and the Parole Act 2002, govern the management of offenders in the community, including those released from prison. Major reforms of the Sentencing Act and the Parole Act were undertaken in 2007. These reforms aimed to enhance the administration of sentences and orders, whilst introducing a number of new community-based sentences as alternatives to imprisonment. Home detention became a 'stand-alone sentence'; giving the judges the ability to direct that the individual serve this sentence as an alternative to a short-term of imprisonment. Further, EM became a special condition of parole, with the introduction of residential restrictions. Community detention was implemented, providing the ability for the judiciary to impose an EM monitored curfew on an offender when they were most likely to offend.

In 2005, New Zealand introduced extended supervision orders (ESOs) for high-risk sex offenders and EM was able to be included as a special condition of this order. Further legislative amendments were made, and subsequently very high-risk violent offenders could also be subject to ESOs. These orders can be imposed for a period of up to 10 years at a time.

These orders focus on monitoring and include reporting to a probation officer, attendance at relapse prevention groups, approval of residence, having restrictions about contact with victims or association with others, and being subject to EM. The EM condition for ESOs was specifically related to a condition of whereabouts, generally precluding an individual from a specified place or premise. This was managed by the use of exclusion zones: this is a geofence drawn on a map which prohibited the offender from entering this area at any given time and could include such places as parks and schools (Department of Corrections, 2010).

Between 2005 and 2010, the Department of Corrections piloted the use of GPS technology in the management of offenders. These pilots were focused on testing GPS monitoring functionality, accuracy and usefulness, and its utility in reducing re-offending. The first trial in 2005 was conducted with staff and non-offender volunteers. The second trial between May 2006 and March 2007 occurred in an active context with a total of 42 offenders who were also on radio frequency monitoring. The recommendation from the trial was to monitor up to 15 offenders using GPS. On average, five or six offenders were monitored at any given time over a total of ten months with the last offender being on GPS until October 2007. The ongoing assessment of GPS concluded that there were limited situations in which GPS could add additional value to the standard EM technology, due to the data being received retrospectively. Individuals were unable to be actively monitored and therefore, the use of GPS was discontinued (Department of Corrections, 2010).

Further advancements in GPS technology enabled an additional trial in 2010 (Department of Corrections, 2010). The testing was undertaken to assist in determining whether GPS should be further considered for use by the Department of Corrections. Corrections staff from throughout New Zealand participated in the trial to replicate offender management scenarios. The objective was to ascertain what, if any, benefits would be achieved from using GPS monitoring with offenders. The trial determined it would allow more effective monitoring of the special conditions that placed restrictions on offenders'

whereabouts outside of their residence. The key to improved offender management was the exclusion zone functionality of GPS which allowed the operator to set zones around places where they did not want the offender to enter (Department of Corrections, 2010).

GPS could assist in enabling offenders to take up employment that would otherwise not be approved, such as with labour pool companies where offenders moved from employer to employer. GPS could also be a supervision tool creating structure and accountability for offenders. Probation officers could use the data provided by GPS tracking to determine if offenders' movements were consistent with their self-report and requirements of their sentence or order. For example attendance at treatment programmes or counselling, and travel restrictions. If the offender did not adhere to these conditions, the probation officers could use this information to hold offenders accountable. Furthermore, they could use the information to ask pertinent questions of the offender, aiding in risk assessment information. In 2012, the New Zealand Department of Corrections implemented GPS monitoring nationwide and, between 2012 and 2015, 200 high-risk offenders were subject to GPS monitoring.

In late 2016, legislation was enacted which allowed for two additional community-based sentences to incorporate the use of GPS monitoring. These being the order of 'released on conditions' and the sentence of 'intensive supervision'. At sentencing, a probation officer could recommend a special condition of whereabouts alongside the use of GPS monitoring as the tool to manage and monitor the condition.

With advancement in technology there are also limitations, and correctional jurisdictions need to ensure they are aware of these capabilities and limitations. GPS requires the use of satellites and cellular networks to record and transmit the location data, and is a useful outdoor technology, but while it frequently will track offenders into buildings or public transport, it is generally unable to transmit location data from within a building (Bishop, 2007). A report into EM in Florida discussed the issue of the frequency of GPS signal reception (Bales, Mann & Blomberg, 2010). Offenders reported losing GPS signal in large

buildings or shopping centres (41.8%), in their homes (21.5%), while other problems were cited as 'anywhere/everywhere' (7.6%) and due to bad weather (3.8%) (Bales et al., 2010). Another limitation of the GPS technology is the margin of error. This refers to when the plots shown on the monitoring map 'drift' from the offender's exact location. This continued to be an issue with GPS systems and could be a concern, when the offender has a condition in relation to geographical restrictions (Correctional Service Canada, 2009).

Research has found that EM has often been used without a clear intent and purpose (Gainey & Payne, 2000). It has been utilised to fulfil multiple objectives including being a deterrent, an alternative to imprisonment, a punishment, a means of holding persons accountable and a tool to rehabilitate and reintegrate (Gainey & Payne, 2000). Given this multiplicity of purposes and principles associated with EM, there have been a range of monitoring schemes, focused on offenders with differing offending and risk and requiring differing levels of involvement and management from sponsors and probation officers.

The evaluation of EM

Evaluating the impact of EM is difficult given the number of different operating procedures, programmes, offender profiles, technologies and methodological approaches. There have been a number of studies conducted into its effectiveness (Bonta, Wallace-Capretta & Rooney, 2000, Mainprize, 1992; Gainey & Payne 2002; Finn & Muirhead-Steves, 2002; Padgett, Bales & Blomberg, 2006; Gainey, Payne & O'Toole, 2000; Gibbs & King, 2003).

Early research focused on completion rates along with re-offending rates. These studies indicated that EM had little to no effect on deterring offenders from criminal activity (Baumer, Maxfield & Mendelsohn, 1993; Lilly et al., 1993). However, Padgett et al. (2006) found that both the use of radio frequency and GPS monitoring technology significantly reduced the likelihood of non-compliance with sentence restrictions and recidivism. Technology helped facilitate compliance, as the offenders were aware any non-compliance

with conditions would be detected instantly. However, the technology will only provide details of the offender's whereabouts as part of monitoring their compliance with the conditions of their order or sentence.

Finn and Muirhead-Steves (2000) explored the utility of EM as a supervision tool with high-risk violent offenders from the U.S. State of Georgia. They compared those who were subject to EM supervision (n = 128) to those who were not subject to supervision (n = 158). The study used a follow-up period of four-years where recidivism was measured by determining those who returned to prison and the time it took for such offenders to return. They found that EM had no effect on reducing re-offending rates for violent male parolees but was more effective for sex offenders, indicating EM could be more effective in deterring certain offence types.

Generally, however, the primary purpose of the implementation of EM was to reduce overall recidivism rates. Hucklesby (2009) sought to investigate offender compliance with EM, with the aim of clarifying the reasons for compliance. The sample consisted of 217 offenders on either stand-alone orders or curfew orders, drawn from two Northern England cities. One-hundred and eighteen offenders completed their order without any formal enforcement action being taken, whereas the other 99 offenders were breached. Seventy-eight of the sample subjected to EM were also interviewed and information was collected on offenders' backgrounds, and their experiences of compliance with and behaviour while serving their sentence. Half of the participants reported that EM helped them to stop or reduce re-offending whereas there was little or no change reported by the other half of the participants. Some of the sample group indicated they changed their behaviour mainly due to the perceived increased risk of being caught, owing to being electronically monitored (Hucklesby, 2009). The study identified there was the opportunity for offenders who were subject to EM to break habits and associations with people, networks, place and environments that were connected to their offending. However, the limitation of the small sample size

indicated that more research is required in this area to validate EM as a tool to encourage compliance. The offenders reported the awareness of being monitored regulated their behaviour (Hucklesby, 2009). Subsequent studies have had mixed findings in terms of the success of EM. Renzema (2003) completed a Campbell Collaboration meta-analysis on the effectiveness of radio frequency monitoring on reducing re-offending rates. They identified 125 studies that had evaluated the use of EM and of these, only 14 included controls groups that were considered suitability matched. Of those 14 only three of the studies included a randomised control group design. The 14 studies in total included 2,664 individuals subject to radio frequency monitoring. Overall, the results showed no significant impact was observed on a reduction in recidivism for those subject to radio frequency monitoring compared to those who were not. Six studies determined the individuals in the radio frequency monitored group re-offended less than individuals in the control group, whereby the remaining eight studies reported no difference or that the control group re-offended less.

A follow-up study revealed that there was no impact detected for EM in terms of reducing re-offending rates (Renzema & Mayo-Wilson, 2005). This study targeted offenders who were assessed as being at 'high-risk' for recidivism. Only three studies were identified which focused on high-risk offenders and included suitably matched control groups for the meta-analysis. No statistically significant differences emerged between the groups from the 1 to 3-year follow-up period. Therefore, EM had no impact on re-offending rates.

More recent studies, however, have evidenced long-term reductions in recidivism when EM is used. Marklund and Homberg (2009) conducted a study in Sweden which found that offenders who were electronically monitored avoided being reconvicted of a new offence during the three-year follow-up period. The study followed 260 Swedish offenders released on EM from prison that were matched and compared to 260 offenders who were released but not subject to EM. Only 26% of the electronically monitored participants re-offended and were convicted of a new offence. For the control group this figure was 38%; the difference

was statistically significant ($p<.01$). However, the study noted issues with the matched control group, as it could not be drawn from a historical population as initially intended. Marklund and Homberg (2009) identified other factors potentially impacting the risk of re-offending, not controlled for, such as the offender's motivation to address their offending behaviour. Therefore, those who applied to be released on EM may have been more motivated to lead an offence free lifestyle then those in the control group.

Another study conducted in Argentina aimed to compare re-offending rates of those subject to EM with those released from prison. A total of 1,526 individuals; 1,140 released from prison and 386 who had been subject to EM were used as the sample groups. The study found that those released from jail re-offended at a rate of 22%, whereas those subject to EM only re-offended at a rate of 13% (Di Tella & Schargrodsky, 2013). However, this study was conducted with those on pre-sentence remand rather than sentenced prisoners. A further limitation of this study was the identification of acceptable comparison groups.

New Zealand Department of Corrections has reported favourable results in the use of EM. In 2016, the New Zealand Department of Corrections reported a 19% reconviction rate for those on home detention (within 12 months of sentence start date) versus 42% for those imprisoned (within 12 months of date of release) (Department of Corrections, 2016). In 2018/2019 the average number of offenders subject to EM as a condition of their order was 168 for parole and 155 for ESO. Of those subject to an ESO, 10.5% were convicted for a breach of that condition and 19.5% were convicted of a new offence. Breach of an EM condition could include failing to adhere to the whereabouts condition and entering an exclusion zone, removal of the anklet and failing to adhere to a curfew (Department of Corrections, 2019). The Department of Corrections in New Zealand has been publishing statistics in its annual reports showing that offenders on EM have reduced re-offending rates. However, given the incomplete information of the studies, including group comparability,

sample size and measurement of recidivism, it is difficult to be sure whether this finding was due to the impact of EM or EM in conjunction with other interventions or treatment.

GPS' effectiveness on recidivism rates

Research on the effectiveness of GPS, specifically as EM supervision, has shown a significant impact on recidivism rates. Padgett and colleagues (2006) found that those subject to GPS monitoring were 95% less likely to re-offend compared to those offenders not subject to such monitoring. The study reviewed data on a sample group of 75,661 offenders placed on home confinement in Florida from 1998 to 2002. The sample included individuals who were subject to home confinement, prison followed by supervision on home confinement, and sentences of home confinement for a violation of probation. To evaluate the utility of EM, three measures were considered using a proportional hazards regression analysis to determine any significant statistical effects. The measures considered were: being convicted of a new offence, a technical violation, and absconding. The study found that those offenders on EM were assessed as 'higher-risk' offenders than those not on EM. Additionally, those offenders who were placed on GPS instead of radio frequency monitoring were assessed as a 'higher-risk' to the community. The study found a 94.7% reduction in re-offending rates for those offenders subject to GPS and radio frequency monitoring when compared to offenders not subject to any form of EM. Bales and colleagues (2010) set out to determine the effect of EM, including both GPS and radio frequency technology as a supervision tool looking at how it impacts on an offender's behaviour in the commission of new offences, technical violations and absconding. A sample of 5,034 medium to high-risk offenders on EM and 266,991 offenders not placed on EM over a six-year period, was obtained from the Florida Department of Corrections. Interviews were conducted with 105 offenders, 36 supervising officers, and 20 administrators. Cox's regression techniques were used to analyse the various outcome measures. The results showed overall that EM reduced the offenders' risk of failure by 31% when compared to

those not subject to EM. Furthermore, GPS monitoring was more effective than radio frequency, with 6% less failures. For over 30 years, Florida heavily invested in EM but research in other states and jurisdictions is needed to validate the impact of EM in those jurisdictions.

Gies and colleagues (2012) conducted a comparison study in the U.S. State of California for a 12-month period between 516 released sex offenders subject to GPS monitoring and those released on parole without EM. To determine the impact and effectiveness of EM, the measures of compliance and recidivism were assessed. Compliance was defined by whether the offender committed a violation of their parole. Recidivism was defined by whether the offender was re-arrested, reconvicted or returned to prison. The results of the study found hazard ratio for the offenders subject to GPS monitoring was 65% lower than those not subject to GPS monitoring. Furthermore, at the time to arrest the hazard ratio was 57% less for those offenders on GPS than those not subject to GPS monitoring. Therefore, offenders not subject to GPS monitoring were twice as likely to re-offend. Gies, Gainey and Cohen (2013) focused on a sample of high-risk gang offenders based in California over a 24-month follow-up period. The study determined that those on GPS monitoring were 20% less likely to be re-arrested but were 36% more likely to commit a technical violation and were returned to custody as a result of failing to adhere to their conditions.

Brown, McCabe, and Welford (2007) and Hucklesby (2009) reviewed the lessons learned in the research literature with respect to using GPS monitoring as a supervision tool to deter and reduce re-offending rates. They found that GPS monitoring deterred offenders from further criminal activity, offenders were conscious they were being monitored and therefore were compliant with their requirements. In addition, the utility of exclusion zones ensured offenders avoided locations and victims. The 24-hours, seven days per week monitoring supported offenders disassociating themselves from former peers. However, research has not

determined the long-term impact GPS monitoring may have on offenders' behaviour modification.

Overall, studies have had mixed results on the impact and effectiveness of EM. However, some studies have shown the use of EM has proven to assist in deterring offenders from engaging in further criminal activity; however it is essential an EM programme must contain rehabilitative and reintegrative components (Hucklesby, 2009). As a result, EM had become a vital instrument in providing stability for offenders in the community, supporting them to remain compliant with sentence and order requirements while providing the opportunity to engage in rehabilitation and reintegration. While more recent studies provide evidence that EM can reduce re-offending rates, no studies on EM have shown the long-term moderating effects of EM. Whilst subject to monitoring, offenders appear to be compliant but 'when the bracelets come off, other studies have found that monitored offenders perform no better than offenders [who] were never subject to monitoring' (Peckenpaugh & Petersilia, 2006, p. 25). Gainey, Payne, and O'Toole (2000) considered the relationship between time an offender spent on EM and the effect on re-offending rates. Their review of the research found mixed results. Gainey and colleagues (2000) conducted their own study and found re-offending rates were lower for those offenders who spent longer on EM. The result however, differed with the type of offender. These findings raised numerous questions about the impact of EM on reducing re-offending rates. Given the evidence and limitations of previous studies, further methodologically strong empirical research is needed to both understand the impact of EM on recidivism and whether EM is more effective for different offence types.

The impact of EM and its surveillance

The introduction of EM technology has created an expansion of penal reform, a new intervention of individual surveillance. It provided an external monitoring control where an offender was subject to spatial and temporal restrictions and was required to adhere to the electronic signalling in order to demonstrate compliance in order to avoid a more severe

punishment. Such measures did not necessarily evoke the internalisation of norms, nor inherently required the change in attitude and behaviour which a probation officer sought (Crawford, 2003).

EM has consistently been considered the main alternative to imprisonment and is seen as a matter of confinement rather than surveillance. However, surveillance is the main component of EM, as the restrictive regime and rules are only imposed because of the monitoring technology. EM can operate as a stand-alone sentence or as a component of any order or sentence incorporating other conditions such as attendance at alcohol and drug programmes or education courses. Given the nature of EM, it is a surveillance-based compliance tool whether it is utilised as a stand-alone sentence or as an aspect of monitoring for the sentences or orders. Therefore, it can either operate as a trust-based and/or threat-based approach to elicit compliance with offenders (Nellis, 2004). It is noted in the study conducted by Nellis (2004) that a failure to comply with EM is more likely to lead to more serious sanctions and penalties.

Gainey and Payne (2004) observed that EM was not the only reason for offender compliance, with the commitment and expectations of families also providing motivation. Community-based supervision entailed keeping appointments and punctual attendance, discussing offending behaviour and considering the necessary consequences should they not comply. Community-based sentences, however, do not place equipment on an offender or in their home. They rely on the offender's description of their behaviour and activities.

The utilisation of EM technology required a considerable amount of personal contact ranging from the field officer who fits and installs the home monitoring units to the monitoring centre staff, to the ongoing contact with the probation officer. The administration of the EM in itself, could lead to high levels of intrusiveness and disruption in the offender's life. Mair and Nee (1990) found half of those subject to EM were annoyed by the intrusion of the equipment, with the anklets not being fitted properly and home monitoring units sending

false alerts. EM research has focused not only on recidivism rates but also on the impact EM has had on the individual and their sponsors. The findings of these studies have been varied. Offenders have reported feeling 'controlled' in comparison to community-based sentences, where offenders on the other hand reported feeling 'free' when compared to a prison sentence (Gainey & Payne, 1998). While individuals have reported feeling restricted and a loss of independence, they still preferred home detention over a custodial sentence (Gainey & Payne, 1998). Families have reported the enjoyment of having their loved one home. However, they have also noted the emotional and financial impact on the household given the practical and logistical implications placed on the family (Gibbs & King, 2003). Church and Dunstan (1997) found EM was a key factor in the offender's life and had a significant psychological impact. Individuals reported the implications of EM were emotionally harder than estimated. This included the offender feeling 'observed' and being 'watched' and unable to manage these feelings, which resulted in some individuals becoming mentally ill. Furthermore, offenders reported feeling stressed and having a poor psychological mind-set when subject to EM. Offenders have further reported becoming fixated on time and obsessed with ensuring everything was done within the time allowed. This perceived time pressure caused stress and anxiety for both offenders and family members (Roberts, 2004; Staples, 2005).

The visibility of the anklet also had differing effects on offenders. Some did not perceive this as being an issue because they were able to easily conceal the device under their clothing and thereby not face any stigma. Others have found the visibility of the equipment obtrusive resulting in individuals applying avoidance and adaptation strategies (Gibbs & King, 2003). Others have found the presence of the anklet served as a constant reminder of the person's 'watched' status and as an encouragement to comply with the requirements and remain offence free (Nellis, 2009).

The research has nevertheless been consistent that offenders prefer EM to imprisonment. It is by no means a 'soft' alternative, given the restrictive nature of home

detention regimes along with the psychological impacts of the surveillance and monitoring aspects of GPS tracking (Venhaelemeesch & Beken, 2013). EM, either sensor or tracking technology, provided coordinates of a person's location, presence or absence. The technology is unable to provide information on who the monitored person is with or their actions and is therefore, not a visual or mental surveillance tool.

Offenders have continually reported experiencing the surveillant nature of EM, rather than the feelings of confinement. This contrasted with a term of imprisonment where the person was removed from the community and placed into confinement. The electronic equipment such as the anklet and home monitoring unit, also resulted in unintended consequences such as placing families under financial pressure and hardship, imposing requirements on sponsors, offenders' use of concealment strategies and fixation on time. The intrusion of home detention on individuals and families had a distressing and negative impact. This raised the important question of whether home detention or home confinement is worth the reduction in re-offending rates, in terms of the philosophical and ethical issues it can present, such as psychological distress on the offenders and sponsors, the intrusion within the home, loss of privacy and potential to net-widen (Gainey & Payne, 2000). Therefore, it is important to explore and understand the psychological impact EM has on individuals, which is a key research question of this study.

EM programmes have proven their effectiveness in terms of compliance while offenders are subject to EM along with short-term reductions in recidivism. However, whether longer-term behaviour modification occurred is unknown. EM, however, has not reduced the prison population as initially intended with the prison muster reaching an all-time peak in March 2018 (Department of Corrections, 2018). The objective of diverting individuals away from prison has worked for a small number, but has not proven to be a successful scheme is terms of reducing the overall prison population.

Overall, the literature does not allow for reaching a strong conclusion regarding the potential effects of EM on re-offending. Research has indicated, however, that EM is more effective when integrated with the use of other supervision and rehabilitative support services and the use of EM should be tailored depending on the unique circumstances and risks presented by the offender (Nellis, 2013). To tailor EM to the monitored individual we need to understand what led the individual to offend in the first place and assess their risk of future re-offending.

Understanding criminal conduct

Research has indicated that in New Zealand the recidivism rate is approximately 70% among offenders within five years of release from prison (Nadesu, 2007). Re-entry into the community is identified as a critical time for offenders, and reconviction rates have been found to be at their highest in the initial weeks and months following release (Nadesu, 2007). Crime and re-offending contribute to victimisation, which has significant emotional, psychological, physical, financial, and social consequences (Piquero, Jennings & Farrington, 2013). Given the social and fiscal impacts of recidivism, correctional jurisdictions have therefore invested heavily in trying to reduce re-offending rates. Risk assessment is a key factor in predicting who will and will not re-offend.

The accurate assessment of an individual's risk of engaging in future offending and the risk they pose to the public is central to the work of staff in the criminal justice system. Risk assessment is critical to the management of offenders as it underpins the decisions and responses made by correctional staff. It informs whether an individual should be released from prison along with determining the associated conditions and how they will be managed in the community in terms of the level of supervision. Risk assessments further inform the pathway to rehabilitation and reintegration, ensuring the person is matched to the most appropriate programmes in accordance with their level of risk (Andrews et al., 2006). Given the fundamental role of risk assessments, these need to have strong predictive utility. Risk

assessment instruments that do not accurately reflect the likelihood of re-offending could place unnecessary restrictions on offenders or place others at risk of harm.

Andrews and Bonta (2010) explained the importance of risk assessments being anchored and based on sound theory. There are numerous theories and explanations of criminal conduct but most theories can be grouped into three general perspectives of crime: a sociological perspective, a psychological perspective, and a social learning approach.

The General Personality and Cognitive Social Psychological (GPCSP) (Andrews & Bonta, 2010) perspective of criminal conduct infers that criminal behaviour is learned. To understand why someone engaged in criminal behaviour, this theory has identified a number of biological, cognitive, behavioural and situational variables which contributed to offending. These included antisocial cognitions, peer influence, self-management deficits, impulsivity or lack of social skills (Ward, Yates & Willis, 2012). Drawing upon the GPCSP, Andrews and Bonta (2006) provided an overview of the theoretical context and psychology of criminal conduct. Bonta and Andrews (2017) examined a number of meta-analyses and concluded that there are eight factors that are consistently predictive of offending. They refer to these as the 'Central Eight' risk factors for re-offending. The 'Central Eight' risk factors include history of antisocial behaviour, anti-social cognition, anti-social associates, anti-social personality (e.g., psychopathy, impulsivity, poor problem solving and poor self-regulation skills), family/martial problems, problems at school/work, lack of prosocial leisure/recreation and substance abuse. These eight factors provide the basis for some of the most predictive risk assessment tools in the field.

Although all of the 'Central Eight' risk factors have been shown to share an association with re-offending, research suggests that some factors have a stronger association with re-offending than others (Bonta & Andrews, 2017). These have been identified as the 'Big Four' and these include history of anti-social behaviour, anti-social personality, anti-social cognition and anti-social associates. The remaining four risk factors have been named

the ‘Moderate Four’ because they show a weaker association with re-offending (Bonta & Andrews, 2017). The more risk factors identified from differing sources of information, the increased likelihood of the ability to predict criminal behaviour. It is argued that the ‘Big Four’ have a greater influence on criminal activity with the ‘Moderate Four’ variables having a moderate impact (Andrews & Bonta, 2010). The GPCSP perspective of criminal behaviour suggested many factors are involved in criminal behaviour.

The Personal, Interpersonal and Community Reinforcement (PIC-R) (Andrews, 1982) perspective was proposed to explain the method by which factors described by the GPCSP perspective are causal in criminal conduct (Polaschek, 2012). In this model, criminal behaviour is the result of learning experiences in conjunction with the personal and surrounding environment, and may provide the model for behaviour whereby there is either a reward or cost. It proposed that criminal behaviour is more likely to occur when the perceived rewards were high and that criminal behaviour decreased when the perceived costs increased (Andrews & Bonta, 2006). The rewards and costs were associated with the personal (feeling of pride or shame), associated with others (family or friends) or are linked to the behaviour itself (feeling relaxed after drug use).

Gendereau, Little and Goggin (1996) found that personal and situational factors were the most predictive variables when predicting future offending. Andrews and Bonta (2010) argued that effective assessment instruments were anchored in theory that identified the selection of relevant variables for assessment.

The perception of the reward/cost equation placed an individual's actions within their control and therefore, when these factors are raised, the chance of an individual desisting in criminal behaviour will increase. The PIC-R explained that all behaviour was always under consequent and antecedent control of the individual. The PIC-R highlighted the importance of assessing offenders across multiple domains to help comprehend what may be sustaining their behaviour (Andrews & Bonta, 2010). It was argued that thorough risk assessments would

ensure an accurate representation of the individual's circumstances, identifying factors which have contributed to the offending behaviour. These factors have been shown to change (Brown et al., 2009) and therefore represented an opportunity for treatment and intervention. It was expected that targeting these factors to promote positive change would reduce the individual's risk of re-offending (Douglas & Skeem, 2005).

The GPCSP and PIC-R perspective of criminal conduct were fundamental to the development of the Risk-Needs-Responsivity (RNR) model (Andrews, Bonta & Hoge, 1990). The RNR model has been one of the most dominant and influential frameworks of offender assessment and rehabilitation across correctional jurisdictions (Polaschek, 2012). The first principle of this model, 'risk', offered guidance as to who should receive intensive treatment or intervention (Andrews & Bonta, 2010). In other words, it specified that criminal conduct is predictable, and that the level of interventions needs to be tailored to an offender's level of risk. In order to facilitate a reduction in re-offending for high-risk offenders, more intensive interventions are required when compared to the level of treatment required for low- risk offenders. The 'needs' principle called for intervention and treatment to be focused on offending related factors (e.g., anti-social associates, substance abuse, anti-social attitudes) that have been identified as contributing to the criminal behaviour. Targeting these criminogenic needs and then positively influencing them is thought to lead to a reduction in recidivism. Criminogenic needs include features of an offender's personality, lifestyle and social circumstances and are incorporated under the 'Central Eight' risk/need factors. These variables were viewed as 'dynamic' risk factors that were amenable to rehabilitation and risk management (Andrews & Bonta, 2006).

The 'responsivity' principle provides guidance for "how" treatment should be delivered and includes two subtypes, 'general' and 'specific'. According to 'general' responsivity the treatment structure should be based on theoretically relevant models that

elicit change in individuals, and that cognitive-behavioural and cognitive-social learning models are best suited to accomplish this.

According to 'specific' responsivity the effectiveness of interventions could be enhanced if attention was paid to the cognitive capacity, capability and learning style of an individual (Andrews & Bonta, 2006). Another dimension to successful outcomes with offenders is the offender's ability to take part in and be receptive to interventions and to change (Andrews & Bonta, 2010).

The RNR model emphasised the importance of reliability in predicting criminal activity, and therefore, the need for strong and accurate evidence based risk assessments were critical for correctional staff. This information was fundamental to sound decision making regarding the level of risk, supervision and intervention required for an individual to reduce their risk of re-offending. The RNR model was the foundation of a number of risk assessment tools, and it has been the dominant theoretical model used to develop evidence based interventions for offenders (Andrews et al., 1990; McGuire, 2013).

An alternative model to RNR is the Good Lives Model (GLM) (Ward, 2002). The GLM was a strengths-based approach with the aim to equip offenders with the necessary skills (internal and external) to live a good life, a life that is socially and personally meaningful (Laws & Ward, 2011). Ward, Yates & Willis (2001) strongly criticised the RNR model in that it failed to consider any other important issues beyond risk factors (Polaschek, 2012; McNeil, 2012). More specifically, the RNR model's sole focus was to reduce an offender's risk of re-offending (Andrews & Bonta, 2006) rather than to enhance and enrich their lives. It has been argued offenders who have not been engaged and motivated with their rehabilitation would have limited success (Willis & Ward, 2013; McNeil, 2012). Gannon and Ward (2014) have further argued that a singular focus on offending related factors failed to recognise societal and organisational barriers to change. Focusing solely on risk factors was unlikely to motivate offenders to develop new ways of thinking about themselves and their

environment. Polaschek (2012) promoted the GLM as an overarching theory that identified key components required to be included in interventions but that it is not an intervention led theory. The RNR principles provided the basis of a successful rehabilitation programme, but do not describe the way in which successful programmes are achieved. As a result, RNR was criticised for the lack of conceptual resourcing to adequately guide programme content, to adequately guide practitioners and to engage offenders (Polaschek, 2012). The GLM of rehabilitation offered a number of strategies to address the negative focus of the RNR model. These strategies included values which underpin rehabilitative practice, explanation and understanding offending behaviour and promoting the offender's goals alongside risk management, looking at self-regulation and ecological variables. Although the GLM offers the explanation of offending occurring because an individual lacks the capability to realise valued outcomes. The model focuses on rehabilitation rather than risk prediction. This study sets out to investigate the predictive utility of the DRAOR which is anchored in the RNR framework and as this study is circumscribed to risk prediction rather than rehabilitation, the GLM is not considered further in the context of the literature review.

Generations of risk assessment methods

Risk assessment methods, to assist correctional staff and clinical professionals with effective offender management have developed rapidly in the past decades. Initial risk assessments were based on unstructured clinical judgements, which were very inaccurate (Hsu, Caputi & Byrne, 2009). Subsequent risk assessments were developed incorporating validated risk and protective factors providing a good level of predictive accuracy for re-offending (Andrews & Bonta, 2010). The four forms of risk assessment can be classified into four generations (Andrews, et al., 2006)

The initial approach to risk assessment was simply based on professional judgement. This practice involved staff being guided by their own opinion, judgement, training and experience to assess and make decisions regarding levels of risk. This subjective method was

known as unstructured clinical judgement. With the assessment of risk based purely on a matter of professional judgement, this method was found to be unreliable and subject to clinicians biases. This resulted in a lack of consistency between clinicians and across jurisdictions (Hsu et al., 2009).

From the 1970s, there was a growing recognition that the determination of risk required it to be anchored in actuarial measures rather than clinical judgement, as clinicians overestimate the risk of re-offending (Andrews & Bonta, 2010). The second generation of risk assessments, therefore, moved towards a more objective method with the use of actuarial tools (Bonta, 1996). These measures incorporated factors that were found to have a correlation with the risk of re-offending. The actuarial risk assessment instruments were comprised of static risk factors, which are historical in nature and not able to change (e.g., criminal history, age at first arrest). Research quickly showed that actuarial assessments were better at predicting criminal behaviour than clinical judgement (Campbell, French & Gendreau, 2009). As a result of actuarial tools being able to differentiate lower-risk offenders from high-risk offenders, these became the preferred assessment approach across correctional jurisdictions.

The second generation risk assessment methods were unable to assess the fluctuation in risk associated with an individual's changing circumstances. Although static risk factors were important in the establishment of an offender's risk level, they were unchangeable and thus limited the ability to identify criminogenic needs, which should guide interventions and risk management strategies (Wong & Gordon, 2006). Recognition of the limitations of actuarial instruments' ability to investigate the offender's current and changing circumstances led to the development of third generation risk assessment methods.

The third generation risk assessment approach continued to rely on static risk factors that were predictive of recidivism but expanded upon the second generation by including relevant dynamic risk variables. Dynamic variables were those risk factors that were amenable to rehabilitation and change, such as severe mental health symptoms, employment

status, criminal associates, and substance misuse. These factors changed over time either rapidly or gradually, with the factors which changed rapidly known as acute and those that changed gradually, referred to as stable (Bonta, 1996; Hanson & Harris, 2000). These factors could be influenced and changed by either external factors and/or treatment. Early research reviews showed that the inclusion of dynamic factors in determining re-offending rates was superior to the reliance on static factors alone (Gendreau, Little & Goggin, 1996). Thus, the assessment of both static and dynamic risk factors allowed for a more accurate assessment of risk and identification of appropriate intervention (Andrews & Bonta, 2010).

More recently, a fourth generation of risk assessments has emerged, making the link between assessment and offender management (Andrews et al., 2006). Not only did this generation of risk assessment focus on risk and needs but incorporated the ability to identify responsivity factors relevant to an offender (Hanby, 2013). This integrated approach informed and assisted with linking offenders into interventions and treatment that would be most effective to address their offending behaviour.

Maruna and LeBel (2003) argued the assessment of risks and needs as 'deficit focused' and correctional jurisdictions need to consider balancing such measurements with an assessment of individual strengths. The desistence research emphasised a number of variables associated with desistance, ranging from personal factors to external influences and were recognised for their contribution to risk prediction and reduction in recidivism. These were known as protective factors and could lower a person's risk to engage in or commit a criminal activity (Tamatea & Wilson, 2009). The initial belief was that protective factors were the inverse of risk factors and were measuring the same construct (Nicholls, Petersen, Brink & Webster, 2011). More recently, research has considered protective factors to be conceptually distinct from risk factors in their predictive abilities (Farrington, Ttofi, & Piquero, 2016). Research in the use of protective factors and their interaction with risk factors is in the early

stages. The evidence to date does support the inclusion of protective factors in risk assessments (de Vries Robbé, de Vogel and Douglas, 2013).

Unlike the risk assessments already discussed, the Structured Professional Judgement (SPJ) approach was not included in the generational classifications (Hanson & Morton-Bourgon, 2009). This approach involved the evaluation of empirically based risk factors by a practitioner (Borum, 1996). For practical use, these scales do not rely on a total score to represent the probability of future re-offending, but rather provide recommendations to prevent recidivism and recognise what potential scenarios (e.g., type of offending, type of victim, etc.) are likely to unfold (Hart & Cooke, 2013).

There was much debate on the accuracy of SPJ in relation to actuarial tools. Some research indicated that the SPJ tools may have had higher predictive utility over score-based assessments (Douglas, Yeoman & Boer, 2005), but the findings are inconsistent (Hanson, 2009). These tools did not fit into the actuarial approach of second and third generation tools, but they assessed a wider range of factors and provided more structure than first generation assessments. The debate about unstructured and structured risk assessment went beyond the predictive accuracy of these approaches to the purpose of risk assessment and the role of professional judgement (Hanson & Morton-Bourgon, 2009).

Researchers have developed and enhanced risk assessments over the years and their utility to predict re-offending has increased significantly. There are numerous instruments that have been developed and validated on a wide range of populations, with some instruments having a higher degree of accuracy for predicting re-offending than others. The inclusion of dynamic risk factors in more recent risk assessments has further improved the utility of these instruments to predict future criminal conduct and how these factors change over time and what that change means in terms re-offending.

The concept of dynamic and protective risk factors

The move towards the incorporation of dynamic factors in risk assessment measures research began to illustrate the importance of fluctuations in risk and how this guided effective offender management (Douglas & Skeem, 2005). However, researchers are unable to agree as to whether dynamic risk factors were causal or correlates of offending, and to what extent they changed as a result of treatment (Heffernan & Ward, 2015; Ward & Beech, 2015).

By definition, dynamic factors must have the ability to change over time and there must be a relationship between the change and recidivism, so if there was a reduction in the risk factor, this would lead to a reduction in re-offending (Caudy, Durso & Taxman, 2013). Kraemer and colleagues (1997) defined dynamic variables with the use of three criteria. Firstly, empirical evidence must show the factor could change over time or through intervention. Secondly, the factor must have had an association with an increase in the risk of re-offending and, thirdly, any change in risk was preceded by an outcome.

Research has further found the difference between risk status and risk state (Douglas & Skeem, 2005; Skeem & Mulvey, 2002). Static risk factors did not change over time; the presence of static factors only indicated the probability of offending occurring in the future. Risk status was the starting point in the determination of the overall risk of an offender. Reliance on static factors limited the ability to identify offending related factors and associated interventions (Douglas & Skeem, 2005). The risk state has been described as an individual's ability to engage in criminal activity based on changes in biological, psychological and social variables in their life. These variables could either change rapidly or gradually. The combination of the static and dynamic risk factors contributed to the overall assessment of an offender's risk. This ultimately led to a better judgement as to when an individual was at risk, and better decision making regarding interventions to manage the risk (Douglas & Skeem, 2005).

Hanson and Harris (2000) further identified the concepts of stable and acute risk factors. Acute factors were defined as variables which could change rapidly and indicated the imminent risk of re-offending. Stable factors were variables which tended to be more gradual and changed over months or years. Hanson and Harris (2000) further suggested that stable factors should be the primary focus of treatment, while acute factors needed to be monitored and managed as a change in these variables indicated re-offending was imminent. In a sample of 409 sex offenders, they attributed stable risk factors as being responsible for the difference between those who re-offended and those who did not. Research has attempted to establish the ability of dynamic risk factors to predict criminal conduct with moderate to high levels of accuracy (Andrews & Bonta, 2006). Although previous studies have indicated that dynamic risk variables are relevant for predicting re-offending, prior research has failed to accurately measure the nature of dynamic risk factors. By examining the risk factor at only one point in time, researchers were essentially treating it as a static variable. Kraemer and colleagues (1997) have suggested that in order to examine change, at least two assessments of risk at different time points is required. Other, researchers have recommended that at least three assessments should be conducted at specified times (Hanson, Harris, Scott, & Helmus, 2007; Quinsey et al., 2006; Quinsey, Jones, et al., 2006).

Brown, Amand, and Zamble (2009) administered three assessments of dynamic risk to assess the change in risk factors and to explore the predictive utility of dynamic risk factors in recidivism, alongside static factors, in a sample of 136 male offenders. The results from a Cox regression survival analysis that included time dependant covariates (e.g., negative affect, employment, criminal association, copying ability) revealed a reduction in problems in areas such as employment, substance abuse, negative mood and social support among a subset of offenders who did not re-offend (n=86). The combined static and dynamic risk measures also significantly improved the prediction of recidivism above and beyond static risk measures (Brown et al., 2009).

In an effort to understand the influence of dynamic risk factors, Zamble and Quinsey (1997) conducted a retrospective analysis of 311 offenders who re-offended following release from prison. A small number of offenders (n=36) who did not re-offend were utilised as a control group. Interviews were conducted with the participants that enquired about living arrangements, past time activities, relationships, employment, substance use, anxiety, depression and anger. Zamble and Quinsey's coping-relapse framework (1997) explained how criminal recidivism was preceded by offenders experiencing a number of interpersonal conflicts and environmental events. Whilst including stable dynamic risk factors, the study found re-offending occurred when one or more acute dynamic factors had increased and were problematic for the individual. Furthermore, the offenders reported feelings of frustration, anger, depression and anxiety, highlighting a second series of acute responses being triggered. The model illustrated that those who re-offended demonstrated poor coping skills compared to those who remained in the community. The coping-release model was fundamental in understanding dynamic risk and how risk factors are central to predicting the immediacy and probability of recidivism (Zamble & Quinsey, 1997).

There has been some research on the utility of protective factors in reducing re-offending rates. When using this approach, assessments should not only focus on an offender's risk factors but also their strengths and resources (Serin, Lloyd & Hanby, 2010). The concept of protective factors has been described and theorised in several ways. Debate continues as to exactly how these factors interact or impact on recidivism. Research to date regarding protective factors has come from the use of protective factors in risk assessments (de Vogel, de Ruiter, Bouman & de Vries Robbé, 2009), in positive psychology through offender management (Woldgabreal, Day & Ward, 2014) and desistance research (Maruna, 2001).

It is posited that these factors 'buffer' the effect of risk, were understood as the inverse of risk factors or were conceptualised as distinctly different from risk factors in their

predictive ability in terms of recidivism (Nicholls et al., 2011; Farrington et al., 2016). However, the one concept which was agreed on is that protective factors have a correlation with a decreased likelihood in criminal activity (Polaschek & Yesberg, 2018). Indeed, Ullrich and Coid (2011) examined the effects of 15 protective factors in violent male offenders following release from prison over a five-year period. Their results indicated that five out of the 15 protective factors significantly reduced the likelihood of a violent reconviction, regardless of the overall risk status, these included social support, emotional support, spending time with friends and family, connection to others, provision of accommodation and being actively employed or looking for work.

Static, dynamic, and protective factors have been identified as the three key areas significantly related to offending. With growing research highlighting the impact and effectiveness of measuring protective factors alongside static and dynamic risk factors, advancements have been made in the development of risk instruments to assist with more accurate assessment of an individual's risk, supporting more effective offender management. Moreover, with respect to the development of risk assessments in the area of forensic psychology and offender re-entry, the field needed to move beyond focusing on static and dynamic risk factors and consider factors that influence crime desistance, namely, protective factors.

The Short-Term Assessment of Risk and Treatability (START) is a SPJ tool developed for use with patients suffering from mental disorders. The tool considered 20 factors, requiring them to be scored as either a vulnerability or an asset. START aimed to help clinicians develop risk formulation for a number of outcomes including, violence, self-harm, suicide, self-neglect, victimisation and substance abuse (Webster et al, 2004). Research has supported the utility of this tool. For instance, Desmarais, Nicholls, Wilson and Brink (2012) investigated the utility of START in predicting inpatient aggression. The START assessment was completed with 120 male forensic psychiatric patients. The findings of the study

supported START as a reliable and valid risk assessment as well as the use of the SPJ approach. It also illustrated the value of incorporating dynamic risk and protective factors to assess violence risk. The results showed that over the 12-month follow-up period, the mean vulnerability score was higher for patients who displayed aggression and the mean strength score was higher for patients who did not demonstrative aggressive behaviour.

The Structured Assessment of Violence in Youth (SAVRY; Borum, Bartel & Forth, 2006) was another risk assessment anchored in the SPJ framework, but designed particularly for use with juvenile offenders. The instrument considered six protective factors and 24 risk factors (10 historical, eight individual and eight social/contextual). Studies reviewing the utility of the instrument have found that protective factors appeared to mitigate the risk of violent recidivism in adolescents (Rennie & Dolan, 2011).

Unlike the aforementioned risk assessment instruments that were developed for use with specific subgroups, the Inventory of Offender Risk, Need and Strength (IORNS; Miller, 2006) was developed to be used with the general offender population. The IORNS is a 130-item self-report measurement set that was intended to assess the static and dynamic risk factors and protective strength factors across all offending domains. A total risk index was calculated which involved subtracting the protective scale from the risk scales. Miller (2006) found differentiation between scoring for those offenders who remained in the community and those reconvicted and returned to prison. Using a sample of 162 male offenders released from the New Jersey prison system, offenders who violated the halfway house rules scored significantly higher on overall risk and dynamic risk needs, while also demonstrating lower protective factors when compared to those who were not returned to prison during a 15-month follow-up period (Miller, 2006). With the incorporation of protective factors, these tools exhibited advancement in the field of risk assessment and offender management. Most of these tools followed the basis of the fourth generation of risk assessment in which the instruments were anchored in the RNR principle in an attempt to create a link to supervision

and intervention. Research on the predictive validity of these instruments continues to grow. As previously highlighted, all of these risk assessment tools target particular populations, whether mentally distressed offenders or youth offenders, with the exception of the IORNS. This thesis will focus on the Dynamic Risk Assessment Offender Re-Entry (DRAOR; Serin, 2007), which is used with adult offenders and is designed to predict general re-offending, including violent offending. This risk assessment instrument not only assesses stable and acute dynamic factors but incorporates the assessment of protective factors, and is designed to be administrated over multiple interactions with offenders (Serin, Mailloux et al., 2012).

The design and implementation of the Dynamic Risk Assessment Offender Re-Entry (DRAOR)

The DRAOR was designed for use with individuals subject to community-based sentences or following release from prison. It was first piloted by the Department of Corrections, New Zealand in 2008 with full implementation in April 2010. The tool's purpose is to assist probation officers with the effective management of offenders. Probation officers complete the DRAOR assessment at each contact with each individual subject to a sentence or order. The assessment is conducted by way of interview as well as taking into account other sources of information from the family, service providers and other agencies such as the police. The repeated reassessment of the individual allows for the probation officer to monitor an offender's risk of re-offending over time; thus, this tool is designed not only to identify if an individual is going to re-offend but also within what timeframe (Serin et al., 2012).

The DRAOR is built on the RNR principles which categorise interventions based on risk and criminogenic needs. Following a SPJ approach, the DRAOR has 19-items distributed across three scales: Stable Dynamic Risk, Acute Dynamic Risk, and Protective Factors. The intent of the tool is that it be used with adult offenders to predict general and violent re-offending, including technical/administrative community control violations (Hanby, 2013).

Risk and protective factors within each scale are scored on a scale of 0 to 2. Risk scenarios are developed by the probation officer in collaboration with the offender looking at what are the most probable situations, contributing factors and types of offences the person would commit should they re-offend. These are based on what is known about the offender and their offending history. This approach identifies risk factors which may precipitate the offence and protective factors that may mitigate the offence. Development of the risk scenarios assists with determining influential risk factors, the level of intervention required to effectively manage that offender. The probation officer will also assess on a scale of 1 to 6 how concerned they are about the offender re-offending prior to their next scheduled report-in, both in relation to either the most likely or most serious risk scenario. A score of 1 would be given if the probation officer was not concerned and 6 if they were extremely concerned about the likelihood of re-offending. This scoring system is also completed for the degree of harm that this offence would incur.

The DRAOR has been implemented across a number of correctional jurisdictions and therefore there is evidence regarding its reliability and validity. A number of studies have investigated the factor structure of the DRAOR and/or examined the predictive utility of the measure. Tamatea and Wilson (2009) conducted a pilot study in New Zealand with seven probation officers and 59 offenders released from prison between October 2008 and June 2009. All probation officers were trained on the use of the DRAOR risk assessment tool and supported in its administration. All offenders were administered at least one DRAOR during their release period. The authors found evidence of the reliability and validity of DRAOR scores, with changes in scores across the factors over time, and moderate correlation between the three domains. In addition, the DRAOR Protective scale (r = -0.33) was negatively moderately correlated to the Risk of Reconviction x Risk of Re-Imprisonment model (RoC*RoI; Bakker, O'Malley, & Riley, 1998) as well as the Stable (r = -0.46) and Acute (r =

-0.41) scales, suggesting that the Protective factors support a pathway type model of offending and desistance from crime.

Hanby (2013) conducted a more comprehensive longitudinal study across a sample of 3,498 offenders which examined the item structure of DRAOR by comparing the initial three scales against two other alternatives. This study found the original structure of the DRAOR had a greater predictive accuracy as compared to the alternative structures. It also found the internal consistency for the DRAOR scales were acceptable for Stable and Protective, but the Acute scale demonstrated poor internal consistency. Hanby (2013) additionally assessed the predictive ability of DRAOR at various intervals and determined that the final assessment conducted with the offender, and specifically the Acute scale, demonstrated the largest association with future recidivism.

Yesber and Polaschek (2015) conducted a principal component analysis which determined an alternative model for dividing the Acute items into internal and external factors; creating four scales rather than the original DRAOR three scale structure. This study was completed using a sample of 299 high-risk parolees and determined, immediately following release, that stable, protective as well as total DRAOR scores were significantly predictive of re-offending outcomes. It was further determined that, the four components model, rather than the three-scale structure, provided greater predictive utility closer to the re-offence date. This study further reiterated that the DRAOR risk assessment had the ability to predict recidivism within a range of offending groups. A limitation of the study was the DRAOR administration was only taken from one time point, essentially treating the risk assessment tool as a static measure. To understand the changes in scores over time and how such changes impact on recidivism and the clinical utility of such assessments, one or more risk assessments are necessary. Such approaches will also enhance our theoretical knowledge of the different categories of factors (static, stable, acute, and protective).

Chadwick (2014) explored the original DRAOR structure against his own empirically formed two scale structure with a sample group of 391 offenders from Iowa. He found that both scales predicted technical violations and re-offending when considered in a Cox regression analysis, but both failed to predict re-offending alone. Chadwick's (2014) findings were based on DRAOR scores taken following release or at the commencement of the order, not the final assessment results. The study failed to consider the DRAOR as a dynamic risk assessment and that the proximal assessment would provide the greater accuracy in predicting re-offending.

The common methodological approach in testing the DRAOR's predictive validity has been based off a singular assessment to identify how well those scores distinguish between offenders who re-offend and those who do not. There have been two approaches which also affected results; recidivism outcomes and follow-up periods. Ferguson (2015), Hanby (2013) and Scanlan (2015) have all utilised the reassessment approach of the DRAOR risk assessment and considered the predictive validity of the scores closest to the time of re-offending. This approach showed these assessments had good validity in predicting recidivism when compared to studies where the initial DRAOR assessment scoring was considered. Two of these studies found that scores on the Acute scale were the better predictor of recidivism than scores on the other domains (Hanby, 2013; Ferguson, 2015). These findings would support the theory that acute items are more strongly associated with immediate recidivism (Hanson & Harris, 2000).

Muirhead (2016) tested the predictive utility of the DRAOR with a sample of 398 young New Zealand offenders aged between (17 – 19 years for a period of 6 – 18 months). Muirhead (2016) found the DRAOR scores were strong predictors of re-offending for youth, with better prediction for general recidivism than violence recidivism specifically. Furthermore, the more recent the assessment was conducted to the re-offending, the more accurate the DRAOR scores were in their predictions. The study further demonstrated that

those who showed greater improvements on the DRAOR scales during their sentence were less likely to be reconvicted when compared to those who were reconvicted.

Overall, research to date suggests the amount of change an individual makes on dynamic risk factors may be related to criminal conduct. Nevertheless, there is still limited research with varying results. The main limitation of the current literature examining change in dynamic factors is that these projects rarely took multiple assessments or rate of change into account. The current study addressed this limitation by taking multiple time points into account, and controlling for the number of assessments conducted for each individual. Furthermore, no previous research has examined the utility of risk assessment in light of EM presence versus absence, which this study will also address.

The current study

As already discussed, New Zealand has utilised EM since the 1990s, but it is only in recent years that GPS technology has been used in the management of offenders by the Department of Corrections. As a result, no research has formally been conducted by an independent researcher into the effectiveness of the GPS programme implemented in New Zealand. There have been mixed results in terms of the effectiveness of EM in reducing re-offending rates across numerous jurisdictions. Support for the use of EM in New Zealand is positive, due to the reported 19% reconviction rate for those on home detention (12 months of sentence start date) versus 42% following release from prison, not subject to EM (12 months of date of release) (Department of Corrections, 2016). However, there have been no data released on GPS monitoring alone. Initial studies conducted across other jurisdictions outside of New Zealand have indicated GPS monitoring is effective in enhancing compliance and reducing recidivism (Hucklesby, 2009). Moreover, EM has become a vital instrument in offender management. However, little consideration has been given to the surveillant nature of the technology and its impacts on the individual's wellbeing. This study aims to further the understanding of the implications of GPS monitoring, its effectiveness in reducing re-

offending and creating long-term behaviour modifications and potential costs to the individual's psychological and emotional wellbeing. Furthermore, to this author's knowledge, no one has ever examined whether risk assessment instruments are differentially effective during EM versus non-EM conditions. New Zealand Department of Corrections is a significant user of EM with a focus on active monitoring rather than passive monitoring, which is more commonly used in other correctional jurisdictions. It will be important to understand the DRAOR's predictive utility across this cohort in association with New Zealand's EM programme. Furthermore, those generally subject to EM in New Zealand except for offenders subject to community detention are assessed as a higher risk of re-offending (Department of Corrections, 2019).

The first objective of this research was to examine the overall effectiveness of GPS monitoring. This was achieved by using two groups of offenders, those who were GPS monitored and another group who were not GPS monitored matched on various demographics and static risk level, comparing reductions in re-offending rates over a 24-month period. The second objective was to evaluate the utility of the DRAOR in predicting future re-offending, with an emphasis on considering both initial and final DRAOR administrations for this purpose as well as assessing dynamic change in scores in predicting recidivism. The third objective was to further understand whether the utility of the DRAOR was different for GPS versus non-GPS monitored offenders within New Zealand. The following hypotheses were tested in light of the stated research objectives:

- Offenders subject to whereabouts conditions requiring GPS monitoring would have a lower 24-month recidivism rate than those who are not subject to whereabouts conditions requiring GPS monitoring (Padgett et al, 2006; Hucklesby, 2009).
- GPS monitoring would have an effect on reducing 'non-violent' re-offending but not 'violent' re-offending. Previous research has found EM has had no effect of reducing rates of re-offending for violent male offenders (Finn & Muirhead-Steves, 2000).

- GPS monitoring would impact negatively on an offender's mood relative to offenders not on GPS monitoring, over the duration of the EM, due to the surveillant and intrusive nature of the technology on the individual (Church & Dunstan, 1997; Gainey & Payne, 1998; Mair & Nee, 1990).
- The DRAOR stable and acute factors would successfully predict recidivism; conversely high protective factors will predict successful desistance from criminal conduct.
- Scores from the final DRAOR administration would be better predictors of re-offending than scores derived from the initial administration (Ferguson, 2015, Scanlan, 2015; Hanby, 2013; Muirhead, 2016).
- It was expected, those who re-offend will demonstrate less improvement in DRAOR scores over time when compared to those offenders who do not re-offend (Muirhead, 2016).
- It was further expected that there would be no difference in the DRAOR's predictive utility for GPS versus non-GPS monitored offenders, as there was no a priori rationale for such an expectation, but this research question was exploratory in nature. Therefore, no formal hypothesis was stated.

Method

Participants and procedures

An archival dataset for this study was provided by the New Zealand Department of Corrections based on researcher requested specifications. A power analysis (G*Power) had revealed that the most complex analysis in terms of statistical power (moderated regression analysis; see 'Data Analysis' section), with a 3% increase in effect size that is commonly observed for interaction terms (e.g., Champoux & Peters, 1987), an a priori alpha of .0125, and expected power of .80, would require a minimum of 364 participants. To ensure stability in observed parameters, *a minimum* of 200 offenders for each group (GPS monitoring versus non-GPS monitoring), who had been released from prison, and matched on demographics (gender, age, ethnicity) and static risk level (see below), was requested for analyses. For matching procedures this meant going slightly above 200 offenders in each group.

A total of 439 offenders who were subject to parole or extended supervision were used with 220 being subject to whereabouts conditions requiring GPS monitoring and 219 offenders who did not require such monitoring. Parole and ESO refers to community supervision by a probation officer following a sentence of imprisonment. In New Zealand, all offenders sentenced to imprisonment for two years or more are released from prison onto a period of supervision by a probation officer for a minimum of six months. Offenders are 'released on conditions' if they are released at their sentence end date and standard conditions are imposed (e.g., notify probation officer of their address and the nature and place employment). Offenders granted parole before their sentence end date may have additional special conditions imposed (e.g., remain at a specified residence, submit to electronic monitoring, undertake specific treatment programmes).

The two groups were generally matched on gender (all men), ethnicity, offence type and static risk scores (RoC*RoI; Bakker et al., 1999). The RoC*RoI is an actuarial risk assessment tool which is an assessment of an offender's risk of conviction and likelihood of

re-imprisonment (Bakker et al., 1999). Each individual had the DRAOR administrated by a trained probation officer at each contact and the data was utilised for the current study. Overall, 51% of the sample identified as Māori, 38.7 % identified as New Zealand European, 9.3% identified as Pacific Islander, 0.5% identified as Asian and 0.2% identified as other ethnicities. Participants ranged in age from 16 to 84 years of age (M = 37.80, SD = 12.45) at the time of their release from prison. About 41% of the sample was incarcerated for a violent offence and 26.4% were incarcerated for sexual offences. The remaining proportion of offenders were incarcerated for property offences (23%) and non-violent offences (9.5%). During the 24-month follow-up period, 320 offenders (72.9 % of the sample) re-offended. The vast majority of the reconvictions were for non-violent offences (59.7%). The average RoC*RoI score for the sample was 0.54 (SD = .22) indicating an estimate of 54% likelihood of returning to prison within five years of release. The RoC*RoI scores ranged from 0.01 to 0.94 for the sample group. The RoC*RoI score range is divided into risk categories, Low = 0 - 0.49, Medium = 0.50 - 0.69, and High = 0.70 - 1. The sample group included offenders with Low to High RoC*RoI scores. A detailed breakdown of the characteristics of the two sample groups is displayed in Table 1. A comparison of demographic information between the sample groups showed there were statistically significant differences in characteristics for age and index offending.

Table 1

Sample group demographics and comparisons across sample group

Demographic	**% GPS** **Est. Mean / SD**	**%Non-GPS** **Est. Mean / SD**	***χ2/t***	***Cramer's V*** ***/Cohen's d***
Age	35.56 / 13.12	40.06/11.32	-3.85*	0.37
Ethnicity				
European	38.6%	38.8%	.00	.00
Maori	48.6%	53.4%	1.01	.05
Pacific Island	11.4%	7.3%	2.13	.07
Asian	0.9%	0.0%	2.00	.07
Other	0.5%	0.0%	1.00	.05
Index Offence **Category**				
Violent	72.3%	62.6%	4.72*	.10
Non-Violent	27.7%	37.4%	-	-
RoC*RoI	.53/.22	.54/.23	-1.00	0.04

*Note. *an alpha = .0125 was used to determine statistical significance (see 'Data Analysis')*

Measure

Dynamic Risk Assessment for Offender Re-Entry (DRAOR). The DRAOR is a 19-item (see Table 2) risk assessment tool developed to assist probation officers in their management of offenders in the community (Serin, 2007; Serin, Mailloux & Wilson, 2012). The DRAOR represents an amalgamation of several theoretical works; stable factors were adapted from research on risk factors for sexual offending to reflect the offending related

factors of general and violent offenders (Andrews & Bonta 2010; Hanson & Harris 2000), while acute factors reflect proximal indicators of risk state (Douglas & Skeem, 2005). Protective factors inform crime desistance and consist of internal assets and external strengths that may reduce the probability of engaging in offending (Tamatea & Wilson, 2009).

Probation officers score an offender's presentation on the DRAOR after each contact, which can range from daily contact to once a fortnight depending on the person's level of risk and engagement with their order. The initial DRAOR assessment provides the baseline measure and repeated administration of the tool captures any changes in the offender's circumstances and changes in any of the dynamic risk and protective factors. The Acute scale is assessed at each contact with the offender with the Stable and Protective scales being reassessed at the probation officer's discretion as new information is ascertained (Wilson, 2011).

For the purpose of this study, the initial and final DRAOR scores were both used as predictors. The first DRAOR assessment completed for each offender was selected to represent the baseline. The last assessment was the assessment completed for each offender prior to recidivism or study end date. This allowed for looking at change in the DRAOR scores over time as an index of risk prediction.

All of the DRAOR factors are scored on a three-point scale. Factors within each scale are scored on a scale of 0 to 2, with 0 being 'not a problem', 1 being a 'possible problem', and 2 being a 'definite problem' for the individual. The protective factors are similarly measured; with a score of 0 indicating the factor is 'not an asset,' 1 being a 'slight/possible problem,' and 2 being a definite asset.

Table 2

DRAOR items by scale.

Stable Scale	**Acute Scale**	**Protective Scale**
Peer Association	Substance Abuse	Response to Advice
Attitudes Towards Authority	Anger/Hostility	Prosocial Identify
Impulse Control	Opportunity /Access to Victims	High Expectations
Problem Solving	Negative Mood	Costs /Benefits
Sense of Entitlement	Employment	Social Supports
Attachment with Others	Interpersonal Relationships	Social Control
	Living Situation	

The presence of stable risk factors would indicate having antisocial associates, antagonistic attitude towards others, poor self-regulation and impulsivity, no consideration of consequences, an inflated sense of self-worth, and exhibiting callousness and indifference towards others.

The presence of acute risk factors would reflect continued problematic use of substances such as alcohol and drugs, marked current presence of anger or hostility and persistent negative mood. They are likely to have conflicted relationships and have unstable living environments and unlikely to be unemployed.

The presence of protective factors indicate a shift in the person's prosocial identity, following advice and guidance from positive influences, having high expectations regarding their rehabilitation and reintegration, having positive pro-social support networks and seeing pro-social behaviour as more rewarding than criminal behaviour, as well as having strong, internalised, pro-social bonds.

Finally, for the purpose of the current study one acute item 'negative mood' has been assessed in greater detail to understand the impact GPS monitoring has on an offender's

emotional and psychological wellbeing. The purpose of this item is to determine whether an offender has either acute negative mood or a continued presence of negative mood (score of 2). Low negative affect or mood involves a state of calmness and serenity, while negative affect can include a variety of aversive mood states such as sadness, hopelessness and fearful worry; the individual may be hyper aroused and they could appear tense, jumpy, restless and nervous (Watson, Clark, & Tellegen, 1988). An offender may experience negative mood as a result of heightened levels of stress. Accordingly, mood and affect appear to change over the short and long-term (Douglas & Skeem, 2005).

Re-offending

The study examined re-offending for up to 24-months for the sample group following their release from prison. The follow-up period allowed for each individual in the sample to have the same opportunity to re-offend. Information was collected on the type of reconviction, the date of reconviction, and the offence type. For this study there were four possible recidivism categories: 'overall re-offending', 'non-violent', 'violent' and 'administrative'. 'Overall re-offending' included all reconvictions for the sample. The 'violent' category consisted of reconvictions for domestic violence, assault and aggravated robbery. 'Non-violent' re-offending consisted of drug related, criminal driving and property offences, whereas the 'administrative' re-offences were defined as technical breaches of either standard or special conditions of release. The re-offending variables were dummy-coded in a binary manner, with type of re-offending ('1') versus those with no re-offending ('0').

Procedures

The data was derived from the Department of Corrections database, the Integrated Offender Management System (IOMS). For the purpose of this study, the two sample groups have been matched on age, gender, ethnicity and RoC*RoI score to the extent possible as described earlier. The scores for the risk assessment (RoC*RoI) in addition to conviction histories and demographic information, were all provided by the Department of Corrections. The researcher reviewed each individual offender in IOMS to ascertain the re-offending data, including offence, date of offence and reconviction along with the outcome.

The DRAOR is administered for every significant contact a probation officer in New Zealand has with someone managed by the Department of Corrections (supervision, intensive supervision, home detention and post detention conditions, released on conditions, parole and ESO). The number of administrations for any offender can vary depending on their risk, compliance and external factors. The DRAOR scores are entered into IOMS by the probation officers.

The scores for the DRAOR risk assessment for each individual offender were obtained by the researcher carefully reviewing each individual case in IOMS recording the initial and final DRAOR scores along with the total number of DRAOR assessments completed for each individual offender in the sample. All variables were then coded for the specific purposes of addressing the research questions.

Data analysis

Microsoft Excel 2010 was used for preliminary data screening and to code variables from raw data records for subsequent analyses using IBM SPSS (version 26).

Descriptive statistics were used to characterise the sample in terms of sample demographics and recidivism rates ('overall re-offending,' 'non-violent,' 'violent,' 'administrative'). The statistical analyses used in this study are outlined below.

For all analysis a conservative alpha level for statistical significance was used. More specifically, because the four main outcome variables throughout the analyses were re-offence variables ('overall re-offending', 'violence,' 'non-violent,' and 'administrative'), a Bonferroni-corrected alpha level was derived from dividing the conventional alpha level of 0.05 by four, resulting in an alpha level of .0125. This alpha level was used to determine statistical significance for all analysis conducted. Effect size estimates were also calculated for all analyses and different estimates were interpreted in accordance with Cohen's (1988) recommendations for small, medium, and large effect size (e.g., r = 0.10 - 0.29 is small; 0.30 -0.49 is medium, and 0.50+ is large).

Age at time of release and violent index offence were significantly different across the GPS and non-GPS monitoring groups as reported earlier. They were also significantly associated with the re-offence outcome variables (χ^2s > 9.95, ps < .0125), which is a requirement for inclusion as a covariate (Miller & Chapman, 2001). However, and perhaps surprisingly, violent index offending was not associated with violent re-offending ($\chi^2 = 2.75$, $p = .097$), and was therefore not included as a covariate in analyses of such outcomes.

To examine the research questions of whether there were differences between re-offending rates in the GPS monitored and non-GPS monitored group, Chi square tests were used to compare re-offending rates between the two subgroups, with Cramer's V being used to determine the strength of the association. To control for age and violent index offending, given the difference between the comparison

groups described earlier (see 'Participants'), a logistic regression analysis was conducted in which age and violent index offending were entered as covariates, along with GPS group membership, in predicting binary re-offending variables. To further explore re-offending rates, the time to re-offence within the groups was incorporated using a Cox regression survival analysis. The Cox regression analysis is a special form of logistic regression that examines the probability for the event to occur across different time-points for the duration of the follow-up period. In other words, a survival analysis not only considers the differential likelihood of the event occurring across groups, but also the differential in time to such occurrence. This analysis incorporated the number of months a person was at risk of reconviction, which allowed for the cumulative survival of the group to be calculated.

A repeated measures Analysis of Variance (ANOVA) was conducted to address the research questions of whether GPS monitoring impacted negatively on an offender's mood over the duration of the electronically monitored period. The repeated measures Analysis of Covariance (ANCOVA) was used to investigate how the DRAOR will predict time to re-offending across the differing re-offence types, whilst controlling for age at release and index offending. This analysis compares means across one or more variables based on repeated observations, that was two-time points here (initial and final DRAOR administrations). To determine the effect size for the partial eta squared was also reported. To determine how much of an effect the scales have on predicting re-offending, Cohen (1988) suggests that partial eta squared of 0.14 or more are indicative of large effect size, 0.06 or more are indicative of medium and 0.01 or higher are small effect sizes.

To determine the predictive validity of the DRAOR scores, a point-biserial correlation analysis was performed with the recidivism ('overall re-offending', 'non-violent,' 'violent,' 'administrative') variables. Moreover, to supplement the

correlation analyses, overall classification utility of the DRAOR scores were also considered. More specifically, Receiver Operating Characteristic (ROC) curve analysis was used to calculate the Area Under the Curve (AUC). The AUC is used to determine if a risk assessment tool is predictive, and this was achieved by examining the differences between re-offending and non-re-offending. The AUC gives the probability that a random subject from the re-offending group has a higher score of a particular measure than a random subject from the non-re-offending group. An AUC of 0.50 indicates that the risk assessment tool is predicting at no better than chance, whereas an AUC of 0.80 indicates that the risk assessment tool can (on average across its set of scores) correctly identify positive relationships 80% of the time. The AUC has been argued to be the preferred measure of predictive accuracy in risk assessment, as scores for the population do not need to be continuous or normally distributed (Rice & Harris, 2005). To determine the effect sizes estimates, Rice and Harris (2005) recommended that AUCs of 0.55 to 0.63 are indicative of a small effect size, 0.64 to 0.70 represent a medium size, and 0.71 and higher represent a large effect size.

To answer the question of how effectively the scores of the DRAOR scales are able to predict re-offending and time to re-offend over the 24-month follow-up period, a Cox regression survival analysis was used as described earlier. Initial and final assessment scores were considered in separate analyses. The Cox regression analysis is also able to incorporate how much a covariate (i.e., DRAOR score) is contributing to the likelihood of an event occurring over time. Analyses were based on the time between release and recidivism or until the end of the follow-up period. Coefficients obtained from Cox regression model are interpreted as hazard ratios, that is, the change in relative rate of recidivism with each unit increase of the predictor variable. Values greater than 1.0 reflect an increase in recidivism risk when

scores are higher on the predictor variable, and values below 1.0 indicate a decreased risk of recidivism. Cox regression analysis was also used to test the incremental validity of the DRAOR scales above and beyond one another as they were all entered simultaneously into the regression equation. Age and violent index offending were entered as covariates given their associations with the outcome variables.

Finally, to investigate the DRAOR's predictive utility across the differing GPS monitoring groups, a moderated Cox regression analysis was performed. To test for moderation, the original DRAOR variable and GPS group membership were entered into the first block, along with the covariates of age and violent index offence, while a new DRAOR x group interaction variable was entered into the second block. The interaction variable was mean-centred, which means that it was calculated by determining the mean for each of the DRAOR scales and GPS group variables, subtracted the observed mean from every participants' score, and multiplying the two centred variables. Moderation was deemed to be present if the mean-centered interaction term conferred a statistically significant increment on the full regression model; in other words, the change of the model chi square from the first to second step was statistically significant.

Results

Group differences in rates of re-offending

First, overall re-offending rates for the sample were calculated. Of the 439 total number of participants in this study, 320 (72.9%) were identified as having re-offended and subsequently reconvicted during the follow-up period. Of these 320 who re-offended, 72 were for violent offences, 65 were for dishonesty offences, 53 were for driving offences, 20 for drug related offending, 90 were for administrative offences and 3 were reconvicted of sexual offending. Among those who re-offended, the average mean time to re-offence was 14.11 months (*SD* = 8.82; range = 1 to 24 months).

To investigate whether there were differences in re-offending rates (defined as any offence that occurred between the release date and the follow-up period of 24-months) in GPS monitored and non-GPS monitored groups at the zero-order level, chi square tests were calculated. Table 3 shows re-offending rates for different offence types across the two groups and associated chi square tests and Cramer's V effect sizes. Although the overall re-offending rates for the non-GPS monitored sample group was slightly higher than the GPS monitored group (76.2% vs 69.5%), the difference was not statistically significant. The only statistically significant difference in re-offending rates between the two groups emerged for 'non-violent' offences. These results indicate the hypothesis that offenders subject to whereabouts conditions requiring GPS monitoring will have a lower 24-month recidivism rate than those who are not subject to GPS monitoring, was only partially supported.

Table 3

Comparisons of re-offending rates for GPS monitored and non-GPS monitored offenders

	% GPS	**%Non-GPS**	***χ2***	***Df***	***p***	***Cramer's V***
Re-offence Category						
Overall Re-offending	69.5%	76.2%	2.50	1	.114	.08
Non-Violent	48.1%	63.9%	6.93	1	.008*	.16
Violent	32.3%	45.8%	3.74	1	.053	.14
Administrative	46.8%	37.3%	1.83	1	.176	.09

Note. An alpha = .0125 was used to determine statistical significance

However, the GPS and non-GPS monitoring groups differed significantly on both age at time of release and proportion of violent index offence, and these variables were also significantly associated with re-offending. Therefore, to control for age at time of release and violent index offending (except for the violent re-offending outcome variable, as it was not significantly related to violent index offending) additional analyses were conducted. More specifically, a logistic regression analysis was used to examine whether the prediction of re-offending rates changed as a result of controlling for the impact of the covariates of age and violent index offending on the outcome variables. Table 4 provides the results for the logistic regression models and odds ratios for predicting re-offending rates for those offenders subject to GPS monitoring versus those who are not. It was found that in addition to 'non-violent' offences, 'violent' offences were also determined to be statistically significant in re-offending rates between the two groups, with medium effect sizes for both re-offence categories. This indicates that those individuals not subject to GPS monitoring had a higher re-offence rate compared to GPS monitored individuals, for the 'non-violent' and 'violent' re-offence categories. These results partially support the hypothesis that offenders subject to whereabouts conditions requiring GPS monitoring will have a lower 24-month recidivism rate than those who are not subject to GPS monitoring.

Table 4

Logistic regression analysis on predicting re-offending rates of offenders GPS monitored versus non-GPS monitored groups controlling for age and index offending.

	$\chi 2$	**B**	**SE**	***P***	**OR**	**95% CI for OR**	
Re-Offence Category						**Lower**	**Upper**
Overall Re-Offending	46.76*						
GPS Monitored Group		-.55	.23	.019	.58	.37	.91
Age		-.05	.01	<.001*	.95	.93	.97
Violent Index Offence		.58	.26	.029	1.78	1.06	2.97
Non-Violent	61.77*						
GPS Monitored Group		-.88	.28	.002*	.41	.24	.72
Age		-.07	.28	<.001*	.94	.91	.96
Violent Index Offence		1.01	.30	.001*	2.76	1.54	4.92
Violent	32.83*						
GPS Monitored Group		-.98	.34	.004*	.38	.19	.73
Age		-.07	.02	<.001*	.93	.90	.96
Administrative	7.66						
GPS Monitored Group		-.22	.30	.465	.80	.45	1.45
Age		-.03	.01	.020	.98	.95	.20
Violent Index Offence		-.04	.35	.917	.97	.49	1.90

Note. OR = Odds Ratio. An alpha = .0125 was used to determine statistical significance.

To further explore the time to re-offending within the groups, a Cox regression analysis was conducted again controlling for age and violent index offence. This allowed for comparison of time to re-offending for the two groups over the course of the 24-month follow-up period. The survival analysis (see Table 5) showed a similar pattern of results to the previous logistic regression analysis (which did not account for time to re-offending). Again, the statistically significant difference was for 'non-violent,' and 'violent' which indicates that those individuals not subject to GPS monitoring, on average, were quicker to re-offend non-violently and violently compared to GPS monitored individuals over the course of the 24-month period.

Table 5

Cox regression survival analysis using GPS monitored versus non-GPS monitored offenders to predict re-offending over time.

	χ2	**B**	**SE**	***Wald***	***df***	***P***	**OR**	**95% CI for OR**	
Offence Category								**Lower**	**Upper**
Overall Re-Offending	40.88*								
GPS Monitored		.26	.12	5.16	1	.023	1.30	1.04	1.63
Age		-.03	.01	31.32	1	<.001*	.97	.96	.98
Violent Index Offence		.21	.12	3.27	1	.071	1.24	.98	1.56
Non-Violent	55.33*								
GPS Monitored		.65	.17	14.47	1	<.001*	1.92	1.37	2.69
Age		-.04	.01	25.98	1	<.001*	.96	.94	.97
Violent Index Offence		.56	.17	11.50	1	.001*	1.75	1.27	2.42
Violent	27.41*								
GPS Monitored		.72	.24	8.80	1	.003*	2.06	1.28	3.32
Age		-.06	.01	23.18	1	<.001*	.95	.93	.97
Administrative									
GPS Monitored	10.38	-.19	.23	.69	1	.408	.83	.53	1.30
Age		-.02	.01	7.62	1	.006*	.98	.96	.99
Violent Index Offence		-.05	.26	.04	1	.843	.95	.58	1.57

Note. OR = Odds Ratio. An alpha = .0125 was used to determine statistical significance.

Figures 1, 2 and 3 show the survival graphs for ‘overall re-offending,’ ‘non-violent’ and ‘violent’ re-offending in the sample group respectively for a graphical depiction of a non-significant and significant results over time for each group. For both graphs, the x-axis shows number of months and the y-axis represents cumulative overall survival.

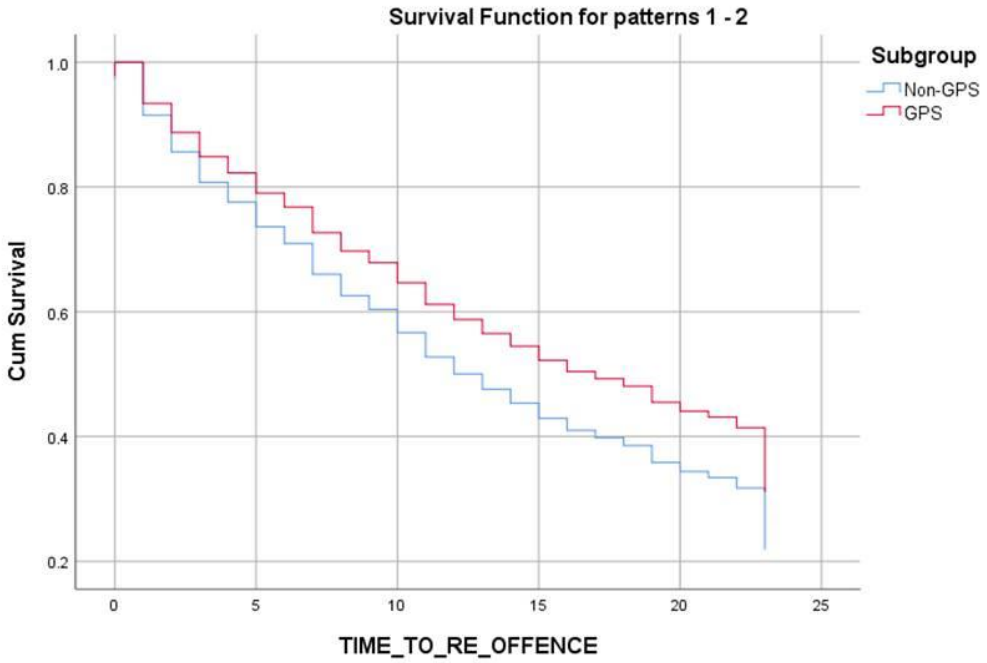

Figure 1. Shows the survival curve for overall re-offending for offenders subject to GPS monitoring versus non-GPS monitored offenders.

Figure 1 shows the survival curve for 'overall re-offending' for both groups. An examination of the slopes shows a steady failure rate for both groups across the 24-month follow-up period. Although the survival rate appears better for GPS-monitored offenders, the difference was not statistically significant.

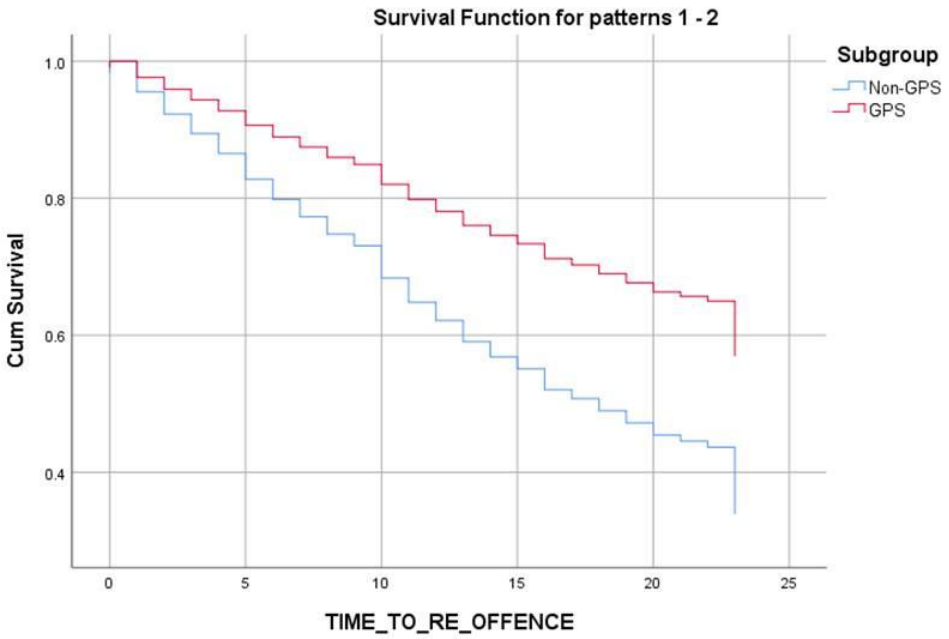

Figure 2. Shows the survival rates for 'non-violent' re-offending for both the GPS monitored and non-GPS monitored groups.

Figure 2 shows the survival curve for the 'non-violent' offence category for offenders subject to GPS monitoring versus non-GPS monitored offenders. The non-GPS monitored group, tended to be reconvicted of 'non-violent' offences more rapidly and to a greater degree than did the GPS monitored group. The difference became apparent within the first 5-10 months of the follow-up period.

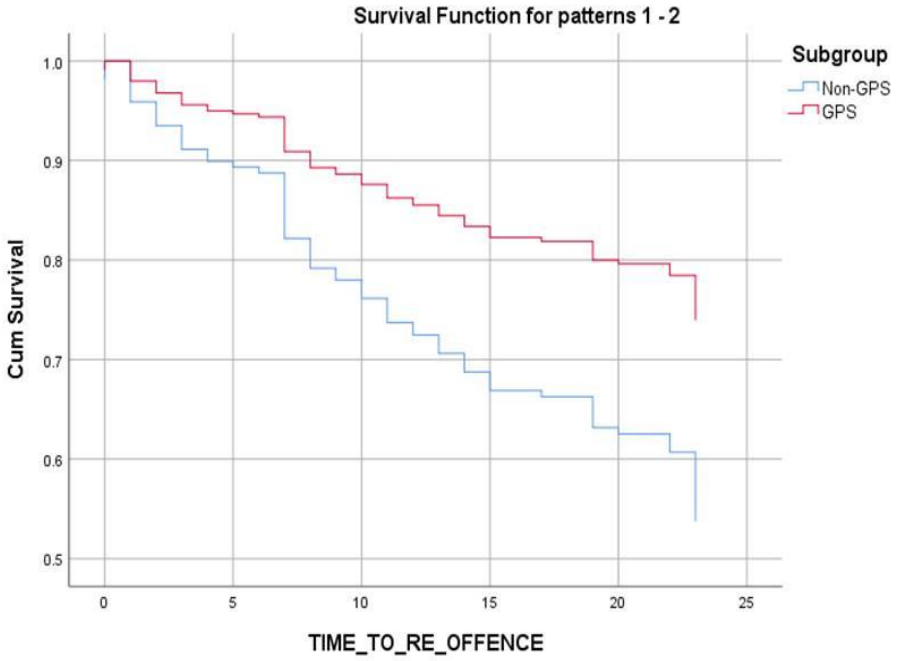

Figure 3. Shows the survival rates for 'violent' re-offending for both the GPS monitored and non-GPS monitored groups.

Figure 3 shows the survival curve for the 'violent' offence category for offenders subject to GPS monitoring versus non-GPS monitored offenders. The non-GPS monitored group tended to be reconvicted of 'violent' offences more rapidly and to a greater degree than did the GPS monitored group. The difference became apparent after the first 7 months of the follow-up period.

Negative mood stability

The second research question of this study concerned the relationship between GPS monitoring and the stability of offenders' mood across the GPS monitored group and non-GPS monitored groups. For this purpose, a repeated measures ANOVA was conducted. This analysis used the acute item 'negative mood' from the initial and the final DRAOR administration to examine the potential relationship between GPS monitoring and negative mood over time. No covariates were used for this analysis as age at release and violent index offending were not related to the negative mood variable. The mean scores for initial negative mood for the non-GPS monitored and GPS monitored groups upon release were similar (.37,

SD = .53 and .34, *SD* = .54). The final assessment of negative mood showed a slight decrease in the mean scores for both groups (.32, *SD* = .53 and .31, *SD* = .53, respectively). However, the results of the repeated measures ANOVA indicated there was no significant change in negative mood over time for the overall sample ($F = 1.38$, $p = .240$, $\eta p2 = .00$), nor was there a significant interaction effect for the GPS monitored group and time ($F = .04$, $p = .84$, $\eta p2 = .00$). The results of this analysis did not support the hypothesis that GPS monitoring would differentially impact negatively on the mood of individuals over the duration of the EM.[1]

DRAOR predictive validity

The next set of research questions concerned the predictive utility of the DRAOR in this sample. Firstly, we examined the degree to which initial and final DRAOR assessments predicted recidivism in the overall sample regardless of GPS monitoring. In order to examine the predictive validity of different types of re-offending using the DRAOR scales, a point-biserial correlation analysis was performed. The results for this analysis are reported in Table 6. The DRAOR scales were consistently associated with re-offending, with small to medium effect sizes. For the initial DRAOR administration, the Stable scale was significantly correlated with all re-offence types, at a small effect size magnitude. However, the Acute scale was only significantly correlated with the 'overall re-offending' and 'violent' types, but not for 'non-violent' or 'administrative' offences, with a small effect size observed for the former two associations. The Protective scale was only significantly (and negatively, as expected) correlated with 'overall re-offending', again at a small effect size magnitude. An examination of the final administration of the DRAOR revealed that all scales were significantly correlated with all re-offending categories. The effect size increased (relative to the initial administration) from small to medium across the Stable scale for all re-offending categories except for the 'violent' offences. Furthermore, the effect size increased to medium for only the Acute and Protective scales across the 'administrative' offence category. The

[1] Controlling for age and index offending as covariates did not have any influence on the results.

effect sizes were smaller for the 'violent' offence category than any other re-offending category, which suggests that the DRAOR may be better at predicting between technical violations and general recidivism, rather than the more serious criminal convictions in this sample. The Protective scale's correlations were negative, as expected, this is because the Protective scale is reverse scored, with higher scores being associated with lower rates of re-offending (Serin, 2007; Serin, Mailloux & Wilson, 2012).

Table 6

Correlation and Area Under the Curve (AUC) estimates for initial DRAOR scale and final DRAOR scales predicting re-offending

	Re-Offence Category			
	Overall Re-offending	**Non-Violent**	**Violent**	**Administrative**
Initial DRAOR	r/AUC	r/AUC	r/AUC	r/AUC
Stable	.20*/.61*	.21*/.60*	.27*/.64*	.20*/.61*
Acute	.11/.55	.09 /.54	.22*/.62*	.08/.53
Protective	-.10 /.54	-.12 /.53	-.10/.55	-.12/.54
Final DRAOR				
Stable	.34*/.71*	.32* /.68*	.27*/.74*	.41*/.74*
Acute	.29*/.69*	.28*/.66*	.23*/.74*	.34*/.70*
Protective	-.28*/68*	-.27*/.66**	-.10/.69*	-.37*/.72*

*Note. The sample size for each category differed, this included a sample of 320 for overall re-offending, 154 for non-violent, 76 for violent re-offending and 90 for administrative offences. Protective variable has been reversed for the AUC values to reflect that lower scores are associated with greater risk. *p< .0125.*

Another approach to examining the predictive utility of a risk assessment is the Area Under the Curve (AUC), which provides information of overall classification utility. Table 6 shows AUCs for the initial and final DRAOR scale scores. The initial Stable scale showed a small level of accuracy (range: 0.60 - 0.64) for predicting all types of re-offending. The initial DRAOR Acute scale for predicting 'violent' re-offending was the only other scale of significant at 0.62, which is also a small effect. It is noted medium to large effect sizes were observed for the final DRAOR administrations across all recidivism types and DRAOR scales

(range: 0.66 - 0.74). The Stable scale in particular demonstrated the best predictive accuracy for each of the outcome measures. All scales showed good predictive accuracy for the 'administrative' offence category (range: 0.70 - 0.74). As expected, the final DRAOR assessments were associated with better classification utility than the initial DRAOR assessments.

Furthermore, to examine how effectively the scores of the DRAOR scales were able to predict re-offending ('overall re-offending', 'non-violent', 'violent' and 'administrative') in conjunction, while also accounting for the time to re-offending over the course of the 24-month follow-up period, eight Cox regression survival analyses were conducted. Cox regressions were performed separately on all initial and final DRAOR scale sets predicting each of the four re-offending variables. For these analyses, age at time of release and violent index offending were also entered as covariates to control for their influence in the prediction of re-offending. The status variable was the re-offence categories. Regression models were estimated separately for initial and final DRAOR administrations. Table 7 provides the results for these analyses. The Stable scale was found to have unique predictive validity for the initial and final DRAOR scores for the 'overall re-offending' and 'violent' re-offending category. Only the initial Stable scale for the 'non-violent' offence category was significant. The Acute scale was only found to have predictive validity for the initial and final DRAOR scores for the 'violent' category. The Protective scale was only found to have predictive validity for the initial DRAOR scores for the 'violent' category.

The odds ratio for each predictor variable within each Cox regression model is also reported in Table 7. The odds ratio indicates the strength of a variable for predicting an outcome, in this case re-offending. The odds ratio represents the predicted change in the hazard (e.g., re-offending) for a unit increase in the predictor (e.g., Stable, Acute and Protective), and can therefore be interpreted as an effect size. The largest odds ratio for the risk scales for 'overall re-offending' category came from the Stable scale for both the initial

administration (odds ratio = 1.12, 95% CI [1.05, 1.20]) and final (odds ratio = 1.10, 95% CI [1.03, 1.17]). For the 'non-violent' category the Stable scale again was the strongest odds ratio for the initial administration (odds ratio = 1.18, 95% CI [1.07, 1.30]). The strongest odds ratio for the risk scale for the 'violent' category came from Protective scale for the initial administration (odds ratio = 1.37, 95% CI [1.16, 1.62]) but was not significant for the final administration. Both the Stable and Acute risk scales were strong predictors for the 'violent' category with initial Stable scale (odds ratio = 1.19, 95% CI [1.04, 1.36]) and final (odds ratio = 1.16, 95% CI [1.01, 1.33]) and initial administration for Acute scale (odds ratio = 1.19, 95% CI [1.05, 1.35]) and the final administration (odds ratio = 1.18, 95% CI [1.07, 1.30]). For the last offence category administration, no scales provided any predictive utility. Overall, this would suggest that the most substantial predictive utility is coming from the Stable risk scale as oppose to the Acute and Protective scales, whether this be from the initial or final administration of the DRAOR assessment. It further suggests the DRAOR may be better at predicting between violent and general recidivism, rather than technical violations in this sample.

Table 7

Cox regression survival analysis examining the predictive validity of the DRAOR scales across re-offence categories

	Model $\chi 2$	B	SE	*P*	OR	95% CI for OR	
	Overall Re-offending					**Lower**	**Upper**
Initial DRAOR	59.49*						
Age		-.03	.01	<.001*	.97	.96	.98
Violent Index Offence		.24	.12	.038	1.28	1.01	1.60
Stable		.11	.03	.001*	1.12	1.05	1.20
Acute		.07	.03	.019	1.08	1.01	1.14
Protective		.01	.04	.736	1.01	.94	1.09
Final DRAOR	110.56*						
Age		-.03	.01	<.001*	.97	.96	.98
Violent Index Offence		.25	.12	.037	1.28	1.02	1.62
Stable		.09	.03	.003*	1.10	1.03	1.17
Acute		.05	.03	.036	1.06	1.00	1.12
Protective		-.04	.03	.152	.96	.90	1.01
	Non-Violent						
Initial DRAOR	58.72*						
Age		-.04	.01	<.001*	.96	.95	.98
Violent Index Offence		.65	.16	<.001*	1.91	1.39	2.63
Stable		.16	.05	.001*	1.18	1.07	1.30
Acute		.10	.05	.036	1.10	1.01	1.21
Protective		.07	.05	.188	1.07	.97	1.19
Final DRAOR	85.47*						
Age		-.04	.01	<.001*	.96	.95	.98
Violent Index Offence		.60	.17	<.001*	1.82	1.31	2.52
Stable		.10	.05	.038	1.10	1.01	1.20
Acute		.07	.04	.063	1.07	1.00	1.15
Protective		-.03	.04	.432	.97	.97	1.05
	Violent						
Initial DRAOR	68.96*						
Age		-.07	.01	<.001*	.94	.91	.96
Stable		.17	.07	.011*	1.19	1.04	1.36
Acute		.17	.06	.007*	1.19	1.05	1.35
Protective		.32	.09	.001*	1.37	1.16	1.62
Final DRAOR	73.20*						
Age		-.06	.01	<.001*	.95	.93	.97
Stable		.15	.07	.003*	1.16	1.01	1.33
Acute		.17	.05	.001*	1.18	1.07	1.30
Protective		-.00	.07	.985	1.00	.88	1.13
	Administrative						
Initial DRAOR	15.76*						

Age		-.02	.01	.007*	.98	.96	.99
Violent Index		.03	.26	.907	1.03	.62	1.71
Offence							
Stable		.13	.07	.059	1.13	1.00	1.29
Acute		.04	.06	.517	1.04	.925	1.17
Protective		.00	.07	.962	1.00	.88	1.14
Final DRAOR	51.64*						
Age		-.03	.01	<.001*	.97	.95	.99
Violent Index		-.05	.26	.859	.95	.57	1.60
Offence							
Stable		.14	.06	.025	1.15	1.02	1.30
Acute		.04	.05	.461	1.04	.94	1.15
Protective		-.08	.06	.147	.922	.83	1.03

Note. OR = Odds Ratio. An alpha = .0125 was used to determine statistical significance.

Predictive validity of change in DRAOR scores

The next analysis focuses on the relationship between change in DRAOR scores over time and subsequent re-offending. It was hypothesised that DRAOR score changes would predict re-offending across the differing re-offence types, with those having *less* improvement in DRAOR scores over time being more likely to re-offend. Repeated measures ANCOVAs were used to test this hypothesis (with age at time of release and violent index offending as covariates); the results are depicted in Tables 8 and 9. The results revealed there was significant main effect for all DRAOR scales across all recidivism categories, except for the Acute scale for the 'administrative' category as displayed in Table 8. The results indicate a change in DRAOR scores over time regardless of re-offending. However, interpretation of these main effects need qualification, as the interaction effects for all DRAOR scales and re-offending categories were also statistically significant. These findings mean that there were differential levels of change in all DRAOR scores over time across all re-offending versus non-re-offending groups.

Table 8

Repeated measures ANCOVA predicting recidivism via change in DRAOR scores

	Main Effect				Interaction Effect			
Offence Category	***F***	***df***	***p***	**ηp 2**	***F***	***Df***	***p***	**ηp 2**
Overall Re-offending								
Stable	16.19	1	<.001*	.04	25.06	1	<.001*	.05
Acute	9.79	1	.002*	.02	17.99	1	<.001*	.04
Protective	33.56	1	<.001*	.07	36.51	1	<.001*	.08
Non-Violent								
Stable	15.56	1	< .001*	.06	11.39	1	.001*	.04
Acute	9.00	1	.003*	.03	10.48	1	.001*	.04
Protective	28.33	1	< .001*	.10	21.65	1	<.001*	.07
Violent								
Stable	20.39	1	<.001*	.10	16.28	1	<.001*	.08
Acute	11.58	1	.001*	.06	13.47	1	<.001*	.01
Protective	50.13	1	<.001*	.21	30.75	1	<.001*	.14
Administrative								
Stable	13.11	1	<.001*	.06	22.64	1	<.001*	.10
Acute	3.84	1	<.051	.02	113.85	1	<.001*	.06
Protective	26.59	1	<.001*	.12	31.40	1	<.001*	.13

Note. Covariates age and violent index offence included, but not reported here. See Tables 4 and 7 for their general impact on findings.

The means and standard deviations for initial and final DRAOR scale scores across the re-offence categories (i.e., those who re-offended against those who did not re-offend) are displayed in Table 9. An examination of these means for the final DRAOR assessment for those who re-offended showed only slight decreases for the Stable and Acute risk scales and increased Protective scale scores when compared to the initial administration of the DRAOR assessment across all re-offence categories. For those participants who did not re-offend, the mean scores for the final DRAOR assessment had substantially greater decreases from the initial assessments for the Stable and Acute risk scales and larger increases across the Protective scale across all re-offending categories. The mean score was higher on both initial and final DRAOR assessments for the Stable and Acute risk scales with lower Protective scores for those who re-offended, while those participants who did not re-offend had lower risk scores and higher Protective scores across all recidivism categories. These means are

consistent with the previously reported findings that both initial and final DRAOR assessments are associated with greater risk for re-offending. In summary, the amount of change on the DRAOR scores was dependent on the individual's ultimate re-offence status, in that the scores had decreased more substantially for those who did not re-offend compared to those who did.[2]

Table 9

Mean and standard deviation for initial and final DRAOR scores across all offence categories comparing those who re-offended and those who did not re-offend.

	DRAOR Scale	**Initial DRAOR M (SD)**	**Final DRAOR M (SD)**
		Overall Re-offending	
Re-offended	Stable	7.27 (2.02)	6.81 (2.79)
	Acute	5.66 (1.98)	5.03 (2.52)
	Protective	5.53 (1.96)	6.15 (2.81)
		Overall Re-offending	
Did Not Re-offend	Stable	6.30 (2.16)	4.52 (2.95)
	Acute	5.16 (2.05)	3.38 (2.27)
	Protective	5.99 (1.97)	7.94 (2.73)
		Non-Violent	
Re-Offended	Stable	7.30 (2.11)	6.69 (2.92)
	Acute	5.60 (1.99)	4.87 (2.53)
	Protective	5.75 (1.96)	6.27 (2.97)
		Non-Violent	
Did Not Re-offend	Stable	6.30 (2.16)	4.52 (2.95)
	Acute	5.16 (2.05)	3.38 (2.27)
	Protective	5.99 (1.97)	7.94 (2.73)
		Violent	
Re-offended	Stable	7.50 (2.06)	6.91 (2.64)
	Acute	6.08 (2.13)	5.57 (2.67)
	Protective	5.62 (2.05)	6.18 (2.55)
		Violent	
Did Not Re-offend	Stable	6.30 (2.16)	4.52 (2.95)
	Acute	5.16 (2.05)	3.38 (2.27)
	Protective	5.99 (1.97)	7.94 (2.73)
		Administrative	
	Stable	7.16 (1.94)	7.10 (2.70)

[2] It was considered that the number of DRAOR administrations could have influenced change in initial to final scores (given more experience with an offender), but including this number as a covariate did not have any influence on the results.

Re-offended	Acute	5.48 (1.89)	5.00 (2.27)
	Protective	5.49 (2.14)	5.81 (2.89)
		Administrative	
	Stable	6.30 (2.16)	4.52 (2.95)
Did Not Re-offend	Acute	5.16 (2.05)	3.38 (2.27)
	Protective	5.99 (1.97)	7.94 (2.73)

Figure 4 depicts means scores for the DRAOR scales for the 'overall re-offending' category, for those who re-offended and those who did not, to graphically illustrate these associations. The x-axis shows the DRAOR administration time (initial and final). The y-axis represents the mean DRAOR score.

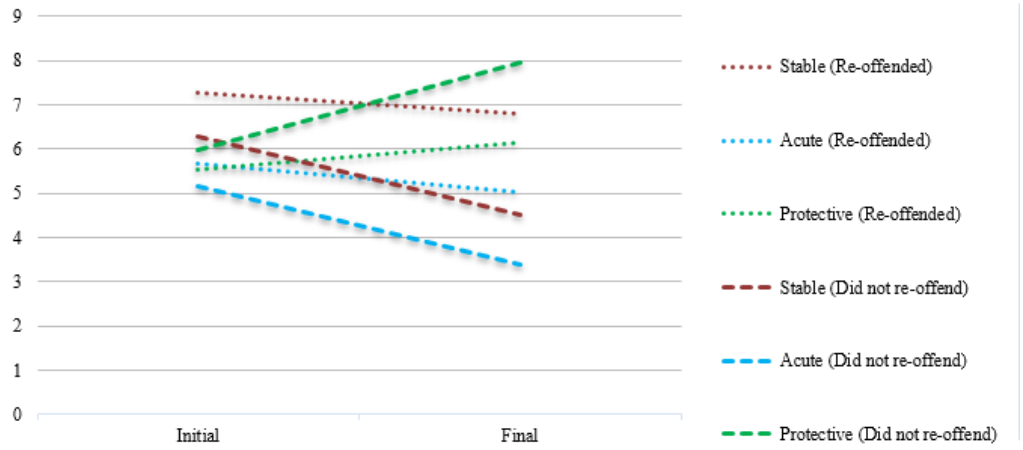

Figure 4. DRAOR scale mean scores over time for those who re-offended compared to those who did not.

Predictive utility of DRAOR across GPS monitoring subgroups

A final research question of this project was whether the DRAOR scores predicted re-offending equally well for offenders subject to GPS monitoring and those not subject to GPS monitoring. To determine whether this moderation effect of GPS status was present, a hierarchical Cox regression survival analysis was conducted. To test for moderation, a mean-centred interaction term was calculated using the original DRAOR scores and a dummy-coded GPS group variable, and this interaction term was tested to determine if it added incrementally to the main effects for DRAOR scores and GPS group in predicting re-

offending. As before, age at release and violent index offending (except for predicting violent re-offending) were entered as covariates in each of these analyses.

Tables 10-13 reports the main effects for the covariates, DRAOR score, and GPS group variable (Step 1) and the interaction term (Step 2). As the effects in Step 1 would merely tell the same information as previous Cox regression analyses, and Step 2 is required for testing of interaction effects, the focus here is on the interpretation of interaction effects to address the question about moderation. For moderation to be present, the interaction term in Step 2 needed to show a statistically significant increment in predictive utility (i.e., significant $\Delta\chi 2$ value) above and beyond Step 1.

As detailed in Tables 10-13, of the 24 regression equations there were two instances of Step 2 adding incrementally to the previous step, this was for the final administration DRAOR Stable scale for predicting 'overall re-offending' and 'non-violent re-offending' categories, providing evidence of moderation. To further explore the moderation effect, follow-up Cox regression analyses were conducted within each GPS group (i.e., GPS-monitored offenders versus non-GPS-monitored offenders) and these results are depicted in Table 14. The findings illustrated that the final DRAOR Stable scale was statistically significant across both the GPS (odds ratio = 1.24, 95% CI [1.17, 1.32]) and non-GPS monitored groups (odds ratio = 1.11, 95% CI [1.05, 1.17]) for 'overall re-offending'. However, the final DRAOR Stable score was only statistically significant for the GPS monitored group (odds ratio = 1.18, 95% CI [1.18, 1.42]) for the 'non-violent' offence category. The results further emphasised that the final DRAOR Stable scale had greater predictive validity for the GPS monitored group than the non-GPS monitored group with odds ratio determining a strong association. In summary, beyond these two instances, there was no evidence for moderation for other instances, so in the majority of cases, the broader conclusion is that the DRAOR risk assessment tool predicts equally well in offenders subject to GPS monitoring when compared to those offenders who are not.

Table 10

Cox regression analysis results showing the differential impacts of DRAOR scales and timing of administration across overall re-offending

Steps	*B*	*SE*	*Wald*	*P*	OR	95% CI for OR		*χ 2(df)*	*Δχ 2 (df)*
						Lower	*Upper*		
			Stable Initial						
Step 1:								59.26(4)*	
Age at Re-offence	-.03	.01	30.21	<.001*	.97	.96	.98		
Violent Index	.21	.12	3.23	.072	1.24	.98	1.56		
DRAOR Stable	.13	.03	20.06	<.001*	1.13	1.07	1.20		
GPS	-.25	.12	4.60	.032	.78	.62	.98		
Step 2:									
Interaction	.05	.06	.83	.363	1.05	.94	1.18	59.44(5)*	.83 (1)
			Stable Final						
Step 1:								103.10(4)*	
Age	-.03	.01	36.37	<.001*	.97	.958	.979		
Violent Index	.16	.12	1.72	.156	.19	1.169	.926		
Stable	.16	.02	59.40	<.001*	1.17	1.122	1.214		
GPS	-.21	.12	3.38	.066	.81	.645	1.014		
Step 2:									
Interaction	.11	.04	7.01	.008*	1.11	1.028	1.203	107.33(5)*	7.04(1)*
			Acute Initial						
Step 1:								52.75(4)*	
Age	-.03	.01	35.24	<.001*	.97	.96	.98		
Violent Index	.22	.12	3.35	.067	1.24	.99	1.56		
Acute	.10	.03	13.10	<.001*	1.11	1.05	1.17		
GPS	-.24	.12	4.31	.038	.79	.63	.99		
Step 2:									
Interaction	.05	.06	.63	.426	1.05	.94	1.17	52.85(5)*	.63(1)
			Acute Final						
Step 1:								91.09(4)*	
Age	-.03	.01	34.97	<.001*	.97	.96	.98		
Violent Index	.25	.12	4.50	.034	1.29	1.02	1.62		
Acute	.14	.02	49.87	<.001*	1.16	1.11	1.20		
GPS	-.25	.12	4.54	.033	.78	.62	.98		
Step 2:									
Interaction	.05	.04	1.64	.052	.20	1.05	.97	92.97(5)*	1.65(1)
			Protective Initial						
Step 1:								47.56(4)*	
Age	-.03	.01	28.75	<.001*	.97	.96	.98		
Violent Index	.22	.12	3.45	.063	1.25	.99	1.57		
Protective	-.08	.03	7.041	.008*	.93	.87	.98		
GPS	-.27	.12	5.36	.021	.77	.61	.96		
Step 2:									
Interaction	.00	.06	.00	.983	1.00	.89	1.12	47.81(5)*	.000(1)*

	Protective Final								
Step 1:									
Age	-.03	.01	37.17	<.001*	.97	.96	.98		
Violent Index	.25	.12	4.55	.033	1.29	1.02	1.63		
Protective	-.14	.02	55.87	<.001*	.87	.84	.90	99.21(4)*	
GPS	-.25	.12	4.72	.030	.78	.62	.98		
Step 2:									
Interaction	-.07	.04	2.91	.088	.94	.87	1.01	100.32(5)*	2.92(1)

Note. OR = Odds Ratio. An alpha = .0125 was used to determine statistical significance

Table 11

Cox regression analysis results showing the differential impacts of DRAOR scales and timing of administration across non-violent re-offence category

Steps	***B***	***SE***	***Wald***	***P***	**OR**	**95% CI for OR**		***χ 2(df)***	***Δχ 2 (df)***
						Lower	***Upper***		
	Stable Initial								
Step 1:								66.92(4)*	
Age	-.04	.01	24.43	<.001*	.96	.94	.97		
Violent Index	.57	.16	12.08	.001*	1.77	1.28	2.45		
Stable	.14	.04	12.61	<.001*	1.15	1.07	1.25		
GPS	-.60	.17	12.23	<.001*	.55	.39	.77		
Step 2:									
Interaction	.08	.08	.98	.321	1.09	.92	1.27	67.04(5)*	.982(1)
	Stable Final								
Step 1:								90.11(4)*	
Age	-.04	.01	25.17	<.001*	.96	.94	.96		
Violent Index	.47	.17	7.88	.005*	1.60	1.15	2.22		
Stable	.15	.03	28.83	<.001*	1.16	1.10	1.23		
GPS	-.52	.17	9.20	.002*	.60	.43	.83		
Step 2:									
Interaction	.15	.06	7.13	.008*	1.17	1.04	1.31	91.37(5)*	7.21(1)*
	Acute Initial								
Step 1:								63.24(4)*	
Age	-.05	.01	28.82	<.001*	.96	.94	.97		
Violent Index	.58	.17	12.39	<.001*	1.79	1.29	2.47		
Acute	.13	.04	9.33	.002*	1.14	1.05	1.23		
GPS	-.64	.17	13.92	<.001*	.53	.38	.74		
Step 2:									
Interaction	.01	.09	.025	.875	1.01	.86	1.20	63.72(5)*	.025(1)
	Acute Final								
Step 1:								89.57(4)*	
Age	-.04	.01	26.85	<.001*	.96	.94	.97		
Violent Index	.55	.17	10.92	.001*	1.73	1.25	2.40		
Acute	.15	.03	28.50	<.001*	1.16	1.10	1.23		
GPS	-.61	.17	12.55	<.001*	.55	.39	.76		
Step 2:									

Interaction	.07	.06	1.627	.202	1.08	.96	1.20	89.68(5)*	1.61(1)
				Protective Initial					
Step 1:								57.80(4)*	
Age	-.04	.01	23.95	<.001*	.96	.94	.98		
Violent Index	.56	.17	11.51	.001*	1.75	1.27	2.42		
Protective	-.07	.04	2.59	.108	.94	.87	1.01		
GPS	-.65	.17	14.24	<.001*	.52	.37	.73		
Step 2:									
Interaction	-.02	.09	.06	.815	.98	.83	1.16	58.20(5)*	.054(1)
				Protective Final					
Step 1:								86.97(4)*	
Age	-.04	.01	26.51	<.001*	.96	.94	.97		
Violent Index	.56	.17	11.38	.001	1.75	1.26	2.42		
Protective	-.13	.03	27.23	<.001*	.88	.83	.92		
GPS	-.59	.17	12.06	.001*	.56	.40	.77		
Step 2:									
Interaction	-.11	.05	4.66	.031	.89	.81	.99	87.34(5)*	4.68(1)

Note. OR = Odds Ratio. An alpha = .0125 was used to determine statistical significance

Table 12

Cox regression analysis results showing the differentia impacts of DRAOR scales and timing of administration across violent re-offence category

Steps	***B***	***SE***	***Wald***	***p***	**OR**	**95% CI for OR**		***χ 2(df)***	***Δχ 2 (df)***
						Lower	***Upper***		
				Stable Initial					
Step 1:								35.73(3)*	
Age	-.05	.01	20.11	<.001	.95	.93	.97		
Stable	.18	.06	9.48	.002*	1.20	1.07	1.35		
GPS	-.73	.24	8.98	.003*	.48	.30	.78		
Step 2:									
Interaction	.02	.12	.04	.851	1.02	.81	1.29	36.07(4)*	.035(1)
				Stable Final					
Step 1:								75.06(3)*	
Age	-.06	.01	27.45	<.001*	.94	.92	.96		
Stable	.24	.04	40.00	<.001*	1.27	1.18	1.37		
GPS	-.47	.24	3.81	.051	.62	.39	1.00		
Step 2:									
Interaction	.16	.09	3.49	.062	1.17	.99	1.38	75.13(4)*	3.50(1)
				Acute Initial					
Step 1:								40.64(3)*	
Age	-.06	.01	26.58	<.001*	.94	.92	.96		
Acute	.23	.06	15.36	<.001*	1.25	1.12	1.40		
GPS	-.60	.24	6.13	.013	.55	.34	.88		
Step 2:									
Interaction	.15	.12	1.57	.210	1.16	.92	1.48	40.69(4)*	1.55(1)
				Acute Final					

Step 1:								75.06(3)*	
Age	-.06	.01	27.45	<.001	.94	.92	.96		
Acute	.24	.04	40.00	<.001	1.27	1.18	1.37		
GPS	-.47	.24	3.81	.050	.62	.39	1.00		
Step 2:									
Interaction	.16	.09	3.49	1.17	.62	.39	1.00	75.13(4)*	3.50(1)
			Protective Initial						
Step 1:								28.03(3)*	
Age	-.05	.01	21.63	<.001*	.95	.93	.97		
Protective	-.05	.06	.60	.438	.95	.84	1.08		
GPS	-.73	.24	8.96	.003*	.48	.30	.78		
Step 2:									
Interaction	.07	.12	.35	.554	1.08	.84	1.37	29.33(4)*	.349(1)
			Protective Final						
Step 1:									
Age	-.06	.01	25.70	<.001*	.94	.92	.97		
Protective	-.19	.04	25.03	<.001*	.83	.77	.89	55.46(3)*	
GPS	-.56	.24	5.52	.019	.57	.36	.91		
Step 2:									
Interaction	-.16	.08	4.03	.045	.85	.73	1.00	55.85(4)*	4.07(1)

Note. OR = Odds Ratio. An alpha = .0125 was used to determine statistical significance

Table 13

Cox regression analysis results showing the differential impacts of DRAOR scales and timing of administration across administrative re-offence category

Steps	***B***	***SE***	***Wald***	***P***	**OR**	**95% CI for OR**		***χ 2(df)***	***Δχ 2 (df)***
						Lower	***Upper***		
			Stable Initial						
Step 1:								16.61(4)*	
Age	-.02	.01	5.70	.017	.98	.96	1.00		
Violent Index	.03	.26	.02	.899	1.03	.63	1.71		
Stable	.14	.05	6.19	.013	1.15	1.03	1.28		
GPS	.20	.23	.74	.391	1.22	.78	1.91		
Step 2:									
Interaction	.02	.12	.03	.855	1.02	.803	1.30	16.96(5)*	.033(1)
			Stable Final						
Step 1:								47.56(4)*	
Age	-.03	.01	11.07	.001*	.97	.954	.99		
Violent Index	-.04	.26	.02	.887	.96	.579	1.60		
Stable	.22	.04	34.42	<.001*	1.25	1.160	1.35		
GPS	.28	.23	1.49	.223	1.32	.844	2.08		
Step 2:									
Interaction	.09	.08	1.42	.233	1.10	.942	1.28	51.80(5)*	1.40(1)
			Acute Initial						
Step 1:								12.09(4)	

Age	-.03	.01	8.45	.004*	.98	.96	.99		
Violent Index	-.00	.26	.00	.990	1.00	.60	1.65		
Acute	.08	.06	2.24	.135	1.09	.96	1.21		
GPS	.19	.23	.67	.414	1.21	.77	1.89		
Step 2:									
Interaction	.09	.08	1.42	.233	1.10	.94	1.28	12.06(5)	.353(1)
			Acute Final						
Step 1:								33.14(4)*	
Age	-.03	.01	9.17	.002*	.97	.96	.99		
Violent Index	.02	.26	.01	.943	1.02	.62	1.69		
Acute	.18	.04	21.75	<.001*	1.20	1.11	1.29		
GPS	.10	.23	.16	.675	1.10	.70	1.72		
Step 2:									
Interaction	.08	.09	.83	.362	1.08	.92	1.27	34.67(5)*	.839(1)
			Protective Initial						
Step 1:								12.26(4)*	
Age	-.02	.01	6.40	.011*	.98	.96	1.00		
Violent Index	-.02	.26	.01	.926	.98	.59	1.61		
Protective	-.06	.05	2.02	.155	.93	.84	1.03		
GPS	.16	.23	.51	.476	1.18	.75	1.85		
Step 2:									
Interaction	.05	.11	.22	.640	1.06	.84	1.32	12.33(5)	.216(1)
			Protective Final						
Step 1:								45.74(4)*	
Age	-.03	.01	10.91	.001*	.97	.96	.99		
Violent Index	-.01	.26	.00	.965	.99	.59	1.65		
Protective	-.20	.04	33.91	<.001*	.82	.76	.87		
GPS	.23	.23	1.01	.316	1.26	.80	1.97		
Step 2:									
Interaction	-.04	.07	.30	.584	.96	.83	1.11	47.34(5)*	.300(1)

Note. OR = Odds Ratio. An alpha = .0125 was used to determine statistical significance

Table 14

Cox regression analysis results showing the differential impacts of final Stable scales for overall re-offending and non-violent re-offence categories

	B	***SE***	***Wald***	***P***	**OR**	**95% CI for OR**		***χ 2(df)***
						Lower	***Upper***	
	Overall Re-Offending							
GPS								70.99(3)*
Age	-.04	.01	28.56	<.001*	.96	.96	.95	
Violent Index	.10	.18	.34	.558	1.11	.79	1.57	
Final DRAOR Stable	.22	.03	50.49	<.001*	1.24	1.17	1.32	
Non-GPS								37.16(3)*
Age	-.03	.01	10.09	.001*	.98	.96	.99	
Violent Index	.27	.17	2.67	.102	1.31	.95	1.82	
Final DRAOR Stable	.10	.03	14.01	<.001*	1.11	1.05	1.17	
	Non-Violent							
GPS								48.00(3)*
Age	-.05	.01	18.18	<.001*	.95	.93	.97	
Violent Index	.47	.26	3.24	.072	1.60	.96	2.68	
Final DRAOR Stable	.26	.05	30.16	<.001*	1.29	1.18	1.42	
Non- GPS								37.91(3)*
Age	-.04	.01	9.80	.002*	.96	.94	.99	
Violent Index	.54	.22	5.87	.015	1.72	1.11	2.67	
Final DRAOR Stable	.09	.04	6.05	.014	1.09	1.02	1.17	

Note. OR = Odds Ratio. An alpha = .0125 was used to determine statistical significance

Key findings

- The GPS and non-GPS monitoring groups differed significantly on both age at time of release and proportion of violent index offences, therefore when controlling for these variables, it was found that in addition to ‘non-violent’ offences, ‘violent’ offences were also determined to be statistically significant in re-offending between the two groups.
- The results further found that those individuals not subject to GPS monitoring, on average, were quicker to re-offend ‘non-violently’ and ‘violently’ compared to the GPS monitored individuals over the 24-month follow up period.

- There was no significant change in negative mood over time for the overall sample. This result did not support the hypothesis that GPS monitoring would impact negatively on the mood of individuals over the duration of the EM.
- The DRAOR scales were consistently associated with re-offending. The Stable scale however demonstrated the best predictive accuracy overall.
- The results further indicate that DRAOR may be better at predicting between violent and general recidivism, rather than technical violations in this sample.
- There were differential levels of change in all DRAOR scores over time across all re-offending versus non re-offending groups.
- The final DRAOR administration unsurprisingly had the greater predictive utility than the initial DRAOR administration for all re-offence categories.
- The DRAOR risk assessment also predicts re-offending rates equally well in offenders subject to GPS monitoring when compared to those offenders who were not.

Discussion

The major objectives of the current study were twofold. The first aim was to explore the impact and effectiveness of GPS monitoring in preventing or deterring further criminal conduct by offenders, and to consider the impact of 24-hour monitoring on offenders' psychological and emotional wellbeing. The second aim was to evaluate the utility of the DRAOR in predicting future re-offending in a sample of adult men serving orders of parole and extended supervision, and in particular, whether such predictions were different for GPS versus non-GPS monitored offenders within New Zealand. The results from this research showed re-offending rates for the non-GPS monitored group were slightly higher than those for who were GPS monitored, but the difference was not statistically significant. The only statistically significant difference in re-offending rates between the two groups emerged for 'non-violent' at the zero-order level, but when controlling for age and index offending, the rates for 'violent' re-offence emerged as significantly different as well. The findings further supported the use of the DRAOR as a useful measure of risk, and its utility in predicting future re-offending within a 24-month period was essentially identical across GPS and non-GPS-monitored groups, with one notable exception discussed later. In the following sections, I provide an overview of the main empirical findings and address the hypotheses for the basis of this research. Theoretical and practical implications of the key research findings are subsequently discussed with reference to relevant literature. Limitations of the current study are then reviewed, along with recommended directions for future research.

Overview of empirical findings

The first set of research questions focused on evaluating the impact and effectiveness of GPS monitoring. The first and second hypotheses considered the difference in re-offending rates and whether GPS monitoring would have a greater effect on reducing recidivism. The results of the study found there was a significant difference in re-offending rates between the two groups, namely those subject to GPS monitoring re-offended less non-violently and

violently than those who were not subject to GPS monitoring. These findings indicate that GPS monitoring acts as a moderator in terms of re-offending specifically for 'non-violent' and 'violent' re-offence categories in this population. Moreover, the survival analyses showed months to the event of re-offence was greater for the GPS monitored group when compared to individuals who were not GPS monitored, for those in the 'non-violent' and 'violent' re-offending groups. These findings, however, did not emerge for the 'administrative' re-offence category, and as a result, this is likely why the 'overall' re-offending rate was also non-significant. These findings would support the conclusion that GPS is a useful supervision tool in both decreasing 'violent' and 'non-violent' re-offence rates as well as increasing the time to re-offence.

Drawing these findings together, one possible reason why GPS is an effective moderator of behaviour is the presence of the anklet and surveillant nature of the technology which serves as a reminder of the person's constant monitored status and provides encouragement to comply with their order requirements and remain offence free (Nellis, 2009). GPS as a monitoring tool can also act to remove destabilising factors and support the overall functioning of individuals in the community. GPS has been shown to reduce exposure to high risk situations for offenders, thereby minimising the likelihood of risk in their environment (Hucklesby 2009). This reduction could occur in a number of ways but GPS monitoring places restrictions on an offender's routine, thereby reducing their exposure to situations or ability to engage in criminal conduct (Berg & Huebner, 2011). This includes the use of exclusion zones to support offenders to avoid locations and victims, disassociate themselves from former peers and assist in deterring offenders from engaging in further criminal activity (Hucklesby, 2009; Brown, McCabe, Welford, 2007).

An unexpected finding of this study was the effectiveness of GPS monitoring to act as a deterrent for those who committed 'violent' offences. It is of note, the effect size in the logistic regression analyses, that 'violent' (0.38:1) was stronger than that of 'non-violent'

(0.41:1), so individuals who are GPS monitored are 2.63:1 *less* likely to re-offend 'violently', whereas those same individuals are 2.44:1 *less* likely to re-offend 'non-violently'. It was not hypothesised GPS monitoring would have an effect on reducing 'non-violent' re-offending but not 'violent' re-offending, given that violent offending or aggressive behaviour has been characterised by spontaneous, emotion-driven responses (Barratt, 1991). It was therefore considered that individuals who engage in impulsive aggressive behaviour might therefore be less deterred by GPS monitoring as they are less likely to consider the consequences of their behaviour and actions. Indeed, researchers have investigated the differing pathways which have led to violent offending. One model has conceptualised how individuals who display aggressive and violent behaviour have lower intellectual functioning and/or impaired cognitive functioning (Beaver et al., 2013; Nixon et al., 2017). Research has determined those who had a lower intellectual functioning were more likely to engage in aggressive antisocial behaviour when compared to those of higher intellectual functioning and that those identified as having higher intellectual functioning were more likely to engage in behaviour to obtain a specified goal or monetary directed antisocial behaviour (Barker, Séguin &White, 2007). Furthermore, cognitive functions have been associated with violent behaviour, namely executive functions. Executive functions are a set of cognitive processes and mental skills that are necessary for learning and development. These processes are responsible for controlling an individual's actions and impulses (Jurado & Rosselli, 2007; Hofmann et al., 2012). Aggressive behaviour has been linked to deficits in executive functioning, namely the inability to control impulsive behaviour, poor decision making and cognitive flexibility, impaired response and reduced planning ability (Blair, 2001; Miura & Fuchigami, 2017). Based on these concepts, and the findings of Finn and Muirhead-Steves (2000), it was not considered that GPS monitoring would act as a preventative measure for individuals with such offending trajectories. This study however did not have all the detail regarding each violent re-offence circumstances, and some of these aggressive offences could therefore have

been more instrumental violence in order to achieve a specific goal rather than impulsive. Alternatively, given the limited research in this area the hypothesis simply could have been wrong. Indeed, the current research would support that the presence of the electronic equipment and GPS monitoring might have made the offenders' conscious and aware of constantly being monitored and enabled them to control any aggressive impulses.

In principle, EM technology increases the likelihood of non-compliance being detected and increases the ability of the probation officers to respond (Hucklesby, 2009). Previous research has found that offenders are conscious they are being monitored and therefore are more likely to comply with the requirements of their order (Padgett et al., 2006; Hucklesby, 2009). The findings of this study illustrated a slightly higher re-offence rate for administrative offences for the GPS monitored offenders than those who were not GPS monitored but this failed to show any significant or meaningful difference. This finding is inconsistent with previous research (Padgett et al., 2006; Hucklesby, 2009), which has found that GPS monitoring significantly reduced the likelihood of non-compliance. However, it is also possible that non-compliance within the GPS monitored group was more likely to be detected as a result of the electronic equipment rather than a higher re-offence rate. Bottoms (2001) proposed four concepts that relate to compliance but in essence argued that an individual's compliance with order requirements are influenced by a number of factors, including situations, environment and others. Bottoms (2001) identified the four aspects to compliance as: instrumental compliance, normative compliance, constraint and habit and routine. Instrumental compliance is the assumption that offenders comply with the requirements of their sentence or order because it is in their best interest to do so. Consequently, compliance occurs when the costs outweigh the benefits or rewards of non-compliance, with the outcome of the compliance or non-compliance being the most important variable in the individual's decision making. The concept of normative compliance is based on moral obligation, social connection and attachment to others, which is where the offender's

compliance is influenced by their own moral norms and significant others producing compliance. Bottoms (2001) also considered the concept of legitimacy whereby if the offender perceived to have been treated justly and fair they are more likely to comply. Constraint is the third aspect of compliance outlined by Bottoms (2001) which refers to external measures being placed on the offender to reduce their opportunity not to comply or to offend, including external measures such as EM monitoring. The last aspect of compliance is habits and routines, whereby the offender is required to change their activities to align with their order requirements and as a result this changes their routine and breaks habits. The implication of this finding suggests that GPS had no influence on formal compliance when compared to those who were not GPS monitored (Robinson & McNeill, 2008). Possible accounts as to why GPS monitoring did not increase or influence compliance, is it is likely the offender was of the belief the reward outweighed the consequence of the non-compliance. Robinson and McNeill (2008) found critical to an offenders' assessment of the likelihood of being caught was their consideration of the reliability of the equipment and breaches being able to be detected. Offenders have been known to test the electronic boundaries and reliability of the equipment to see if non-compliance is undetected (Hucklesby, 2009). Furthermore, equipment problems and malfunctions are also factors which offenders consider in their decision making using this as either the ability for the non-compliance to be undetected or using the equipment issue as an excuse or argument to incorrect location data. Other considerations will relate to the potential punishment for non-compliance. Legal enforcement action, such as a breach of parole or recall to prison to continue serving their sentence of imprisonment are not always immediate responses to non-compliance (Department of Corrections, 2020). In practice, probation officers have discretion in the way they respond to non-compliance. The response to non-compliance must match the seriousness of the non-compliance event and mitigate the offender's level of risk; this could include formal warnings, removal of approved absences/outings, increase in reporting requirements to

breaches of parole and applications for recall (Department of Corrections, 2020). As a result of these procedures, offenders may consider the likelihood of formal enforcement action or a return to prison as low, increasing the likelihood of the decision for non-compliance. Understanding the reasons why GPS monitoring had little to no effect on compliance will require future exploration.

Although the initial hypotheses were only partially supported, the findings raise interesting implications and questions regarding the use of GPS monitoring, specifically that EM has different effects, depending on the type of re-offending, and has a greater risk reduction potential for those offenders who commit 'non-violent' (e.g., dishonesty, drugs, driving) and 'violent' (e.g., assault, aggravated robbery, injuries with intent to injure, sexual) offences but has little effect on deterrence for offenders who commit 'administrative' offences (e.g., breaches of parole). It is argued that while reducing re-offending related risk factors and propensity to offend is the long-term goal, minimising exposure to opportunities or high risk situations in an offender's environment is an equally important short-term goal (Cullen et al., 2002). If GPS monitoring helps to contribute to the long-term goal of reduction in re-offending by having a moderating effect on an individual's behaviour and the short-term goal of reducing an individual's exposure to high risk situations through surveillance, restrictions and monitoring, there is the potential to facilitate better outcomes for offenders and the community.

The third research question considered the impact of GPS monitoring and the stability of offenders' mood across the GPS monitored group and non-GPS monitored group. It was hypothesised that GPS monitoring will impact negatively on offenders' mood, over the duration of the EM, due to the surveillant and intrusive nature of the technology on the individual. The results did not support this hypothesis, and rather, indicated there was no negative effect on the mood of the offenders whilst subject to GPS monitoring. The findings were contrary to those of Church and Dunstan (1997) who found there were significant

psychological impacts from EM. These inconsistencies in findings across studies likely illustrate that different EM programmes might have differing impacts on an individual's wellbeing. Previous research which has focused on the impact that EM has on the individual and sponsors has predominantly examined the experiences of offenders subject to home detention (Church & Dunstan, 1997; Mair & Nee 1990; Gibbs & King, 2003). Home detention requires an offender to remain at an approved address at all times and be monitored 24-hours a day, seven days a week, only being able to leave the residence with the approval of the probation officer, whereas with GPS monitoring the offender is not restricted to the residence. The technology is used to monitor the whereabouts of the offender. This finding suggests the more restrictive the EM programmes, the more intrusive it is on the offender's life, causing stress and anxiety (Roberts, 2004; Staples, 2005). This distinction is important for future research because it will help us to better understand the impacts of differing EM programmes.

The second set of research questions concerned the predictive validity of the DRAOR, including whether differences in predictive utility would emerge across GPS and non-GPS monitored offenders. The DRAOR scales consistently predicted re-offending, with the Stable risk scale generally demonstrating the highest predictive accuracy across offence types. The findings further demonstrated that the DRAOR may be better at predicting between violent and general recidivism, rather than technical violations in this sample.

The results highlighted the utility of the DRAOR and its scales to differentiate between those who re-offended and those who did not. As hypothesised, recidivists had higher levels of stable risk and acute risk and lower levels of protective factors than non-recidivists at both the initial and final assessment periods. The classification utility of the DRAOR was established using ROC curve analysis. The DRAOR scales consistently predicted re-offending, with higher effect sizes observed for the final DRAOR administration, as expected. Contrary to the hypothesis that recidivism and desistance from crime would be

best predicted from Protective factors, the Stable scale demonstrated the highest predictive utility. The findings of this study do not support the theory of acute items being more strongly associated with immediate recidivism (Hanson and Harris, 2000) at least in the current sample that consisted of 50% of offenders being GPS monitored. These findings in fact contradict the intended purpose of the Acute scale. The Acute scale was developed to be regularly monitored due to the rapid changeability of acute factors and that changes in these variables indicate re-offending is imminent (Serin, 2015).

The Stable scale includes items such as peer association, attitudes towards authority, impulse control, problem solving, sense of entitlement, attachment with others; factors that have been theorised as greater sources of risk and relate directly to Andrews and Bonta's (2006) the 'Big Four' which have been validated as the best predictors in the likelihood of re-offending. The Acute scale includes items such as substance abuse, employment, living situation, interpersonal relationships, which are needs that relate directly to those factors which have been determined to have a moderate influence in the development of criminal conduct and are included in the 'Central Eight'. It has been argued on empirical grounds that the 'Big Four' have a greater influence on criminal activity than the moderate four (Andrews & Bonta, 2010). Therefore, it is actually consistent with the broader risk assessment literature that the Stable scale would have stronger predictive utility relative to the Acute scale. These findings further highlight the need for probation officers to consider stable risk items more carefully, taking into consideration an increase in Stable scale scores or no changes as indicators of potential risk of re-offending. This approach will assist probation officers to take action aimed at mitigating potential re-offending. Of course all DRAOR scales and factors need to be considered and should not be ignored as they are all predictive in their own right; but the stable might necessitate particular attention, especially in GPS monitored offenders.

A further research question concerned examining the degree to which the initial and final DRAOR assessments predicted recidivism in the overall sample. As the DRAOR

assessment tool is administrated immediately after an offender's release, it is essential to understand the utility of these initial assessments in predicting criminal conduct. It would be expected that those who receive a higher DRAOR risk score and lower protective factors scores are more likely to re-offend, whilst those with lower stable and acute scores with higher protective factors are less likely to re-offend. The results revealed, as expected, that the final DRAOR assessments were greater predictors of re-offending for all re-offence categories than the initial assessment. This finding was true for all risk scales and was expected given previous research had found the final DRAOR assessment had the greatest accuracy (Ferguson, 2015; Scanlan, 2015; Hanby, 2013; Muirhead, 2016), which is due to the ability of the probation officers to take into account third party information from police or family members helping build an accurate picture of the individual's circumstances. Continually assessing and re-assessing the factors which predict recidivism provides a more accurate foundation for determining present or ongoing risk. As the DRAOR is a dynamic risk assessment tool, it was essential to assess how individuals' scores changed. Indeed, one of the research questions of this study examined how changes in scores over time influenced prediction of re-offending, examining the differences between those who re-offended and those who did not in relation to their rates of change. Firstly, it was found that for those who re-offended, scores only slightly decreased on the Stable and Acute scale and slightly increased on the Protective scale between the initial and final DRAOR assessment. For those participants who did not re-offend, the Stable and Acute risk scales scores on the final DRAOR assessment decreased substantially (and significantly) from the initial assessments and larger increases were observed for the Protective scale across all re-offending categories. This finding provided support for the hypothesis that dynamic and protective factors change over a period of systematic assessment and re-assessment within an individual offender, and that the DRAOR is sensitive to change. These results are in line with findings from Hanby

(2013) and Ferguson (2015), who also observed risk scores decreasing and protective scores increasing over time.

As this study is the first on DRAOR specifically for a New Zealand male population subject to GPS monitoring, it was important to consider the DRAOR's predictive utility within this cohort. Therefore, a final research question of this project was whether the DRAOR assessment predicted re-offending equally well for offenders subject to GPS monitoring versus those not subject to GPS monitoring. Although the majority of findings pointed to equality of predictive utility across groups, some demonstrated that the final administration of the DRAOR Stable scale had even greater predictive validity of 'overall re-offending' and 'non-violent' re-offending for the GPS monitored group than the non-GPS monitored group. Although no individual DRAOR item analyses was completed for this study, some consideration of such might suggest that the Stable scale's efficacy at predicting re-offending better for the GPS monitored group is because of the inclusion of risk factors such as impulse control, attitude towards authority and problem solving. It is likely these risk factors are more pertinent to offenders subject to GPS monitoring, due to their inability to regulate their behaviour, necessitating the need for an external control such as GPS monitoring as a mitigation and supervision tool to help manage their risk of re-offending. However, given that it was only the final administration Stable scale that was found to be of statistical significant for only two re-offence categories, in the broader context of the findings (i.e., 22 of 24 moderation effects were non-significant), it was concluded that the DRAOR risk assessment tool predicts equally well in offenders subject to GPS monitoring versus those who are not. Overall, the findings of this study support the continued use of the DRAOR regardless of whether the individual is GPS monitored or not.

Implications

The research findings also offered several key implications. First, the current study tentatively supports the risk reduction potential of offenders who are GPS monitored. The findings highlight the need to take into consideration the application of GPS monitoring with differing offence types, namely being more effective in reduction of re-offending and time to re-offence for general and violent recidivism than administrative or technical compliance. Since 2012, New Zealand Department of Corrections has expanded and increased the use of GPS monitoring in the use of offender management. In 2018/19, the number of offenders subject to EM as a condition of parole was 168 and 155 as a condition of ESO. The average length of an EM condition for parole was 1 year, 8 months, 2 days, and as a condition of ESO was 7 years, 8 months, 5 days (Department of Corrections, 2019). The cost of EM on average for an offender per day is $69 ($25,185 per annum). Although the findings potentially favour GPS monitoring as an effective deterrent from non-violent and violent criminal conduct, the difference in risk of 'non-violent' and 'violent' re-offending was 1.92:1 and 2.06:1, respectively, for non-GPS monitored offenders based on the odds ratios from the survival analyses. More specifically, those who were not GPS monitored were on average twice as likely to re-offend over time compared to those subject to GPS monitoring. The logistic regression analyses, which did not account for time to re-offending showed the difference in likelihood of 'non-violent' and 'violent' was 0.41:1 and 0.38:1, respectively, for GPS monitored offenders based on the odds ratios (or, in other words, 2:44:1 and 2.63:1 *less* likely to re-offend). This indicated that those who are GPS monitored were approximately two and half times less likely to re-offend compared to those who are not GPS monitored. Therefore, further policy implications not only include decisions on which types of offenders should be subject to EM but whether EM is a cost-effective and efficient tool in the reduction of recidivism. This study did not include a cost analysis of EM versus imprisonment, but New Zealand Department of Corrections may want to consider their commitment to GPS

monitoring in relation to cost versus the proportional improvement in re-offending rates, at least for the explicit purpose of reducing re-offending. On the other hand, there was no evidence of increased psychological distress for those subject to GPS monitoring based on probation officers' ratings of negative mood. This finding, combined with the fact GPS monitoring did produce meaningful reductions is recidivism, may further outweigh the monetary cost associated with EM programmes, as reducing re-offending and making New Zealand a safer place are the key objectives of New Zealand Department of Corrections.

The current study provided evidence that the DRAOR scores as well as change in scores predicted recidivism across all re-offence types. Thus, the DRAOR, as a dynamic risk scale, can inform probation officers of risk and help improve offender management decisions. Jones (1996) argued that inherent fluctuations in dynamic risk factors make them volatile, impacting their reliability and validity. However, differences were observed across the DRAOR scales for 'overall re-offending,' 'non-violent' and 'violent' categories in the 24-month follow-up period. Instead of viewing repeated measurements as a shortcoming, this study shows that continually re-assessing dynamic risk and protective factors using the DRAOR takes into account the offender's current criminogenic state and changes in the environment, and improvement in these scores is associated with reduced re-offending. The utility of this approach allows for appropriate changes to supervision strategies to be implemented depending on changes in dynamic risk and protective factors. Not only do dynamic risk factors inform us when an offender is at a higher risk to re-offend, but also how to reduce that risk (Hanson, 2006).

As mentioned earlier, the current research highlights the importance of considering the stable risk domains in the management of risk in which stable factors significantly contributed information to the prediction of re-offending. A focus on acute risk factors has narrowed probation practice in considering how the Stable scale and protective factors are predictors of re-offending. Due to the changeability of acute risk factors, probation officers

are trained in the need to constantly re-evaluate and monitor the acute risk items as it has been suggested a change in these variables indicates re-offending is imminent (Hanson & Harris, 2000). As a result, probation officers tend to focus solely on the Acute scale with only a watching brief over the Stable and Protective scales (Serin et al., 2012). An important contribution of this study is the need for current probation practice in New Zealand to shift focus and attention to stable risk factors, rather than the sole adherence to the Acute scale. Stable risk factors are personal skill deficits and learned behaviours, that correspond with criminal conduct, but can be changed through effortful intervention (Hanson & Harris, 2000). Efforts should be focused on these dynamic risk factors given how predictive they were in this sample group.

The findings on the rates of change for DRAOR scores over time provide probation officers with crucial information. If an offender is not showing improvements in their DRAOR scores as quickly as others, this has indicated they were more likely to re-offend. This finding alone provides significant implications for current probation practice. Anecdotally, probation officers are known to focus solely in changes in scores on DRAOR items and do not necessarily consider the impacts of no movement or improvement in DRAOR items (Department of Corrections, 2020). Probation officers could use this information to intervene and support the offender prior to them re-offending. Such intervention would not only help the individual avoid future criminal activity, but also reduce the potential harm of re-offence to a potential victim and the community (Lipsey, Chapman & Landenberger, 2001).

Not only did this current study tentatively support GPS monitoring as a risk reduction method but another crucial aspect is the DRAOR assessment tool functioned equally as well in predicting re-offending across the GPS monitored and the non-GPS monitored groups. There was nothing about GPS monitoring which would prevent the use of the DRAOR risk assessment with this cohort of offenders. If anything, it highlighted that

DRAOR is useful for assessment of risk in GPS monitored offenders and how the stable risk factors were better at predicting risk of re-offending in the GPS monitored offenders. With better understanding, not only will our confidence improve with its use, but allow for the DRAOR risk assessment and its use to be refined and targeted for offending groups.

Strengths, limitations, and future directions

Every effort was made to conduct the present research using approaches that were methodologically sound, which included having a New Zealand representative offender sample, a sample size with sufficient statistical power for analyses, and GPS and non-GPS groups matched on important variables (gender, ethnicity, static risk). Multiple DRAOR ratings were considered, which allowed for estimating changes in DRAOR scores in risk prediction. The study also included a 24-month follow-up period, providing sufficient time to reveal important differences of re-offending behaviour of the different subgroups.

Although this study highlighted a number of important aspects as to how GPS monitoring and the DRAOR perform, there are some limitations in light of which the conclusions must be considered, and that also provide avenues for future research. First, the generalisability of these findings to other offender populations is questionable. The current sample was limited to male offenders from New Zealand; as such, the results may not be representative of female offenders or those from other countries. This limitation is based on evidence that women and men have different pathways into and out of crime, and certain risk factors may be more prevalent or be differentially predictive of recidivism for men and women (Andrews, Guzzo, Raynor, Rowe, Rettinger, & Wormith, 2012). Moreover, the utility and applicability of both EM on both re-offending and the DRAOR risk assessment should be examined on lower-risk populations, as a majority of research has considered offenders subject to parole or those who have committed sexual offences, who generally are of higher risk of re-offending. Indeed, the overall rate of any re-offending in the current sample was 72.9%. Although more recent studies have considered the predictive utility of the DRAOR on

specific subpopulations such as female and youth offenders, these are limited in number, and further research is required to understand the DRAOR's predictive utility across different offending cohorts. However, as of December 2019, 80% of the offending population in New Zealand were male with only 18.2% under the age of 24 years (Department of Corrections, 2019). Therefore, this sample is nonetheless highly relevant to the current New Zealand context.

I tried to match the GPS and non-GPS monitoring groups perfectly, however suitably matched groups can be difficult to achieve given the number of variables which impact on recidivism including, gender, age, employment status and assessed risk (Bonta, Wallace-Capretta & Rooney, 2000). Care was taken to match the groups sufficiently on ethnicity, the RoC*RoI and index offence to the degree possible. Age at release and violent index offence were two variables which were significantly different across the two groups and also related to the re-offending outcome variables. There was a small difference in that the non-GPS monitored offenders were older, which could have potentially had a "protective" effect for those offenders, as research has shown crime often reduces with age (Smith et al., 2002). Indeed, when controlling for age and index offending, differences emerged more clearly, and at larger effect size estimates, between GPS and non-GPS groups with respect to re-offence rates.

The DRAOR data used for this research was not gathered for this intended purpose; rather, probation officers undertook completion of the DRAOR as part of their normal practice. As a result, an issue with this approach was the timing and frequency of the completion of the DRAOR assessment for each offender, namely these were not uniform. Some offenders had two assessments in one week, whereas others had a period of a month between assessments. This infrequency posed a potential problem when it came to analysis of the final assessment, as some offenders' final assessments were substantially closer to the re-offence or end of their order. To mitigate this limitation, we examined both initial and final

administration DRAOR scores, considered time to re-offending in survival analysis, and accounted for change in the DRAOR scores over time. The total number of the DRAOR administrations was also considered as a potential covariate, but it did not have any effect on predicting re-offending. However, in order to address this issue in a more satisfactory manner, future researchers should consider an approach where the DRAOR assessment is conducted on a set frequency for all offenders throughout the duration of the study, as a formal longitudinal analyses that considers multiple time-points (e.g., growth curve analysis) would potentially be more appropriate.

There are also measurement concerns regarding the DRAOR and re-offending outcomes that should be considered. Although a number of validation studies of the DRAOR have been performed, there is no information available about inter-rater reliability and how probation officers score the DRAOR. This issue makes it difficult to know whether, for example, probation officers across the country have the same understanding of the evidence that merits a rationale of '2' (definite problem) compared to '1' or '0'. Some items are more subjective to score than others. We also do not know the therapeutic relationship between the offender and their probation officer and how this may influence quality and accuracy of information disclosed. Therefore, the measurement error is unknown. However, at least somewhat mitigating concerns about measurement error is the fact that the results of this study did show meaningful effect sizes, even if potentially attenuated to an unknown degree.

The negative mood variable of the DRAOR assessment was utilised to assess the stability of offenders' mood across groups and over time. This factor has definite parameters focused on negative affect and cannot be considered the optimal measure to determine an offender's emotional and psychological wellbeing when subject to EM. Unfortunately, this study was confined to data available through the Department of Corrections. Future research should use well-validated rating scales and self-report inventories for such measurement to determine if the findings reported here do indeed replicate.

Re-offending is often considered the optimal standard by which to measure the effectiveness of correctional tools and interventions; however, it must be acknowledged there are a number of conceptual and methodological limitations with its accurate measurement. These limitations include the various interpretations and definitions of re-offending, with measures of recidivism including re-arrest, reconviction, imprisonment, re-arraignment or probation violations (Andersen & Skardhamar, 2014; Ruggero, Dougherty & Klofas, 2015). The current research made allowances by considering time to failure; however future research should consider more sensitive and descriptive measures of individual offending trajectories than a simple re-offence / no re-offence dichotomy (e.g., reduction in the severity / frequency of crime). Taking a broader approach to recidivism measures will provide more meaningful information as to what is effective in crime reduction (LoBuglio & Lyman, 2006). Furthermore the DRAOR is rooted in the RNR model which focuses on risk and does not consider the importance of human needs and their influence on behaviour, such as the GLM. As previously discussed the GLM is about the enhancement of the offender's wellbeing and accordingly the best way to create a safer community is to assist offenders to adopt a more fulfilling life (Ward et al., 2011). Given the presence of electronic monitoring equipment and the tracking ability of GPS monitoring, it would be interesting to explore how GPS influences the offender's actions and behaviours in the context of the GLM. Consideration of a broader approach to recidivism measures and looking at GLM as a difference context in which GPS could be studied will in turn support correctional jurisdictions to make more informed decisions about good correctional interventions and practice.

Conclusion

This study was the first validation of GPS monitoring of offenders within New Zealand. Furthermore, it was the first validation of the DRAOR specifically for offenders subject to GPS monitoring in New Zealand. The findings provide a fresh insight into GPS monitoring and the predictive utility of the DRAOR, and contribute to our understanding of

how these tool can be used within a correctional setting. Overall, the findings favoured GPS monitoring as an effective deterrent from non-violent and violent offending and provided support that the DRAOR is a useful risk assessment tool regardless of whether EM is applied. These findings are important, as not only will we be able to provide the most effective form of monitoring, our increased understanding of the DRAOR scales and rates of change for the DRAOR scores will enable us to intervene if and when necessary before any further offence is committed.

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